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Autumn in the Home Farm

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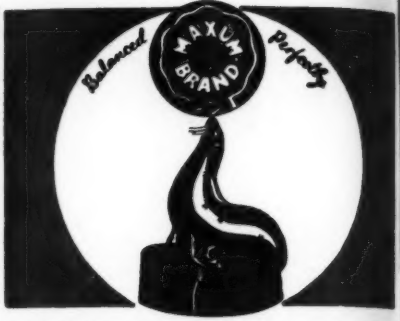

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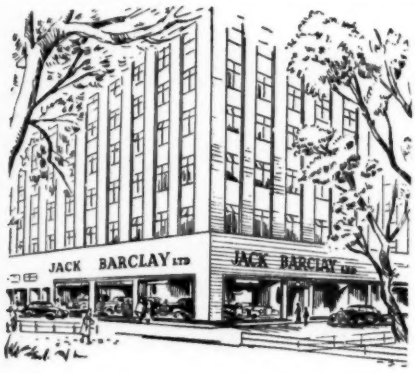

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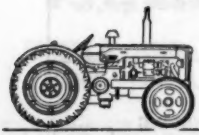

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Cover Photograph

Return to the Home Farm at East Garston, near Lambourn

AGRICULTURE

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BY-PRODUCT SHEEP

K. P. RILEY, B.A., N.D.D.(H.)
Gloucestershire Farm Institute

To the mixed lowland farm, sheep offer, says Mr. Riley, a profitable and easily adaptable sideline which makes little or no demands on labour or special equipment.

THE nature of mixed farming is frequently misunderstood and wholesale academic attacks are mounted against it. In so far as the attack is on "bits and pieces" farming, there is no doubt sound justification. But, short of absolute monoculture, which is seldom permanently successful and only so under very definite trade and agricultural conditions, some degree of mixed farming is inevitable. The question is not really whether to specialize, but in what to specialize and how to select companion lines of production. We know, for example, the specialist potato grower who finds it desirable to rest and restore his land and so grows grass. He may also find it economic to grow cereals and is led on to dispose of his small potatoes and grain through his own pigs. He remains a specialist potato grower, but unless he is in a very large way of business, his other lines may not be as specialized as they might be. So, too, the grower of malting barley must find an outlet for his tail corn. The introduction of stock—say, pigs—and the growing of other crops—say, fodder beet or potatoes—may not only offer this outlet, but will help to spread the gross peaks and troughs of labour requirement that could arouse serious labour difficulties in these enlightened days of constant and regular employment. Who was it that described Canadian wheat farming as "six months' hard labour followed by six months' enforced idleness"?

Over the country as a whole and particularly in the west, there is a marked bias in favour of milk production, and indeed a few farmers may be equipped so as to specialize in dairy farming to the exclusion of all other lines. But, generally speaking, farm size, herd accommodation, labour and housing problems militate against *complete* specialization. It is to farmers with a dairy herd and depending largely on grass that sheep offer themselves as a suitable sideline.

Adaptability to Farm and Market To many the keeping of sheep suggests all too often one enterprise: sometimes one for which they have no love. But for the mixed lowland farmer sheep offer, in fact, a wide choice of financial and farming enterprise with a ready shift from one to another. A farmer may, for example, keep a flying flock of ewes, served by a purchased ram—not a single enterprise but a variety in itself. He has the choice of selling ewes and lambs together in the spring and early summer, he may sell fat lamb in the spring, summer and autumn, he may sell store lambs in autumn, or he may carry them on him-

self. Young ewes bought at fairly high prices may be kept or sold for further breeding. Old ewes will cost less, but most of them will have to be replaced. His enterprise—considered as one of many—shows a whole range of adaptability to market and farm needs.

He may not wish for anything so permanent as a ewe flock. He may want part occupation for labour and a means of consuming crop residues in winter. Fattening hoggs and shearling wethers could supply it. The margin per head may not be very large, but there often is a margin and following crops are benefited without expense. He may find himself in need of grazing companions to his other stock in summer. Shearlings will provide it.

Between these many sheep enterprises, each man must choose for himself to meet his own farm and market needs. But the choice is there and it is wide. In many instances transfer from one to the other is easy, and what is more, capital in sheep enterprises on grassland and mixed farming systems is almost entirely in sheep. Nothing significant is sunk in equipment, and usually nothing at all in buildings and fixtures. Little then is left on the hands if the market changes and a clearance seems wise. Nor need sheep be kept long before realization. It is always possible after a few months and is commonly accomplished in six.

At the Gloucester Institute we have so far seen no need to sell out of sheep. We buy young Kerry and Clun ewes, as do so many farmers on these Western Marches, and they stay with us some two or three seasons before being replaced by others. For the past four years they have been mated with an Oxford ram, but at the moment we are using a Suffolk. All lambs are sold fat. The number of ewes fluctuates a little, but over the four seasons from 1950 to 1954 we had an average of 40 ewes breeding and suckling. These 160 ewe-years contributed £2,082 in gross income to the farm—£13 per ewe per year.

Economics of Mixed Grazing. This bald statement suggests profit. But in analysing profit on a mixed farm we must be quite certain that the sheep are a true subsidiary. Is their apparent cost reduced because they have not in fact competed with the other, and major, stock on the farm for grass or crops at some time? Is their apparent cost less because the labour must be there in any event? It is difficult to answer these questions exactly—but not impossible to get a general answer.

If we assume that there has been *no* by-product effect, then against our £13 income we must set figures like the following:

	£	s.
To: Grazing	3	4
Hand feeding		17
Labour	1	0
Depreciation	1	7
Sundry costs		10
Total cost per ewe	6	18

This suggests an eventual profit per ewe of over £6, which, to say the least, is not unsatisfactory. But if we could measure really accurately, I suggest that this is a minimum figure, for there is indeed a by-product effect. The maintenance needs of ewes are low from July to September and late October to January (I assume an orthodox lowland period for service). It is positively undesirable to allow breeding sheep to get fat in these periods. Sheep are "tip" feeders: that is, they can pick, choose, scavenge and, in general, manage to retain health in these periods merely by topping over pastures which have carried (or even continuing to carry) other stock.

The practice of mixed grazing on this farm appears to us to lead to the production of excellent pastures and possibly a lower level of parasite infestation. While it may be true that five or six sheep would replace one cow, it seems to us that one sheep does not replace one-fifth of a cow. In other words, a non-competitive level of stocking is possible for much of the year. We believe that such mixed stocking has a beneficial effect on pasture and the species that graze it, provided the by-product level is observed. We find ourselves heartened in this observation by the latest Cockle Park report, which continues to show, after twenty-one years, a 100 per cent superiority in animal output from mixed stocking.

Even when good feeding is required most definitely—before and after lambing—economies are possible. Forward cereals on our stiff marl may often be grazed by sheep, but not by cattle, and if grazing does not go on too long there seems to be no diminution of yield. Young leys may be stimulated in spring by the ewes grazing before cattle can be turned in. A combination of folded poultry and sheep seems to be as beneficial for old grassland and for the stock as any we have tried. All these are economies applicable on the mixed farm.

Sheep make few Demands on Labour Then what of labour? In the four years 1951-54, the crops and stock at the Institute farm were sufficient to account for some 3,200 man-days annually. The permanent labour force was eight, including the bailiff. Even with student assistance on the root crop, there is surely enough work left for our permanent staff. Of that figure, only 40 man-days could be attributed to sheep. If we had no sheep we could hardly reduce our staff; and without sheep we could find no other ancillary enterprise to occupy the 40 man-days which would require so little capital. A couple of sheep racks, a few rolls of netting and stakes, and a dozen hurdles represents almost our entire sheep equipment.

But, in fact, in mixed farming with a by-product flock the time spent on sheep does not, and need not, amount to one man-day per ewe. It is hard to convince a man of this after a week's lambing, but most of the time taken in shepherding a largely grassland flock is in routine daily checking and counting, and in periodic flock movement and control. Our bailiff, who is very good with sheep, has to walk the farm. Our workers also have to cross it. It is seldom, then, that the daily check appears as a timesheet item. Sheep are often moved by workers going to and fro on other legitimate occasions. This, immeasurable but true, is a real by-product effect possible on many mixed farms—and only on mixed farms.

We are not in any way exceptionally situated at the Institute. Our land is stiff, but not unworkable; our elevation is moderate in rolling lowland country our rainfall is fairly regular, but not excessive; our main output is milk and poultry products; our main crop is grass. There are many similar farms to which the small flock could come, bringing with it increased income and demanding but little in the way of extra expense.

WINTER WHEATS RESISTANT TO EYESPOT

F. G. H. LUPTON, M.A.
Cambridge Plant Breeding Institute
and
R. C. F. MACER, B.A.
Botany School, Cambridge

Trials at Cambridge last year indicate that, although none of the four varieties of winter wheat tested was immune to Eyespot, there was far less loss of yields with Cappelle Desprez than with the others.

EYESPOT is a serious disease of cereals which was first recorded in this country by Glynne [1] at Rothamsted in 1935. Since that time it has been reported from most parts of the country, particularly in the eastern coastal counties, where severe losses have been caused in crops of winter-sown wheat in recent years.

The disease is caused by the fungus *Cercosporella herpotrichoides*. Primary infection of seedlings of a susceptible crop of wheat or barley is brought about by spores which are splashed by windblown rain from pieces of stubble of a previously infected crop during the winter months. Plants or tillers may be killed at this time, resulting in a thinning out of the crop; in the following spring characteristic elliptical lesions are seen on surviving infected plants. During the spring more spores are produced on these plants, causing a secondary spread through the crop. The effect of the fungus at this stage is to rot the tissues at the base of the stem, so that later in the season the crop has a straggled appearance or may lodge completely. This makes harvesting difficult, and is also associated with a reduction in the size and number of grains produced.

Eyespot [2] and Take-all [3] are the two principal diseases limiting the production of good quality grain under conditions of intensive cereal cultivation in Britain. Eyespot is the more serious on heavy soils and Take-all on lighter land. Garrett [4, 5] has shown conclusively that Take-all can be controlled by short breaks from susceptible crops in the rotation, aided by well-timed applications of nitrogenous fertilizers. Storey [6] and Glynne and Moore [7], however, have shown that one year is often not enough to control Eyespot, but a rotation which allows for two successive non-susceptible crops seldom leads to trouble. Such measures as reducing the seed rate, delaying the date of sowing, or applying nitrogen in late spring only, would do much to reduce the effects of the disease.

Varietal differences in susceptibility to Eyespot were recorded in the Report of the Norfolk Agricultural Society for 1950 [8], in which it was claimed that Cappelle Desprez was less severely attacked than other wheat varieties on their experimental farm at Sprowston. This observation was confirmed by reports from the Continent describing varietal differences in susceptibility to Eyespot. In view of these claims, it was decided to carry out a controlled experiment to estimate the importance of varietal resistance to Eyespot under conditions in Britain.

Trials at Cambridge A small-scale trial was therefore laid down at Cambridge in the autumn of 1953 to test the resistance to Eyespot of four varieties of winter wheat—Bersée, Cappelle Desprez, Squarehead's Master and Yeoman. These varieties had previously been used by

Glynne (⁹) in greenhouse experiments. The trial was designed as a randomized block with four replications. To obtain a measure of the losses caused by Eyespot, each plot was divided into two portions, one of which was infected, the other acting as a control for purposes of comparison. Infection was carried out in early December by placing pieces of wheat straw inoculated with the fungus at intervals of 4 inches along the drills of plots to be infected.

Within fourteen days, spores were being formed on the inoculated straws, the production of spores continuing until late in the following spring. In this way, behaviour of naturally infected stubble in the field was closely followed, the characteristic Eyespot lesions first becoming visible in early April. A sample row of each plot was lifted on June 1, and a record made of the percentage of ear-bearing shoots showing lesions on the stem, after the removal of the leaf sheath. It was found that Cappelle Desprez gave a significantly lower percentage of infection and Yeoman a significantly higher percentage of infection than the other two varieties. It was also found that the lesions on Cappelle Desprez were less extensive than those on the other varieties, and that the fungus had not penetrated so deeply into the tissues of this variety. The data obtained are given in the table.

Variety	Ear-bearing Stems Infected (June 1, 1954)	Estimated Lodging of Infected Plants at Harvest	Ears per Foot of Drill at Harvest	Yield*		Loss in Yield	Ear-bearing Stems Infected at Harvest
				Non-infected Plots	Infected Plots		
	per cent	*per cent*		*per cent*	*per cent*	*per cent*	*per cent*
Cappelle Desprez	37.8	nil	16.2	100 (21 cwt. per acre)	98.5	1.5	82
Bersée	50.0	30	15.0	90.3	61.3	32.0	77
Squarehead's Master	52.5	50	14.2	55.7	48.0	14.0	91
Yeoman	77.0	100	14.7	59.0	37.0	37.0	100

*Expressed as percentage of non-infected Cappelle Desprez

The lodging characteristic of Eyespot infection was first seen in early July on the infected plots of Yeoman. As the season advanced, the symptoms became more severe, until by harvest time these plots were completely lodged, although the uninfected plots of this variety were still standing. Lodging also occurred in the infected plots of Bersée and Squarehead's Master but began later in the season and was less extensive than that in the infected plots of Yeoman. No lodging was seen in any plot of Cappelle Desprez. It is known that a thinner plant establishment may result in a less severe infection at harvest. Such differences in establishment cannot account for the differences seen here, however, since all plots were sown at a uniform rate of one gramme of grain per foot of drill, and it was found that the number of ears per foot of drill of Cappelle Desprez was greater than that of the other three varieties. A count at harvest time showed that a high proportion of ear-bearing stems of all varieties were infected by this time (see table).

Yield figures from the trial show that Cappelle Desprez significantly outyields Squarehead's Master and Yeoman in both infected and uninfected plots. Bersée is equivalent to Cappelle Desprez in the uninfected plots, but is significantly outyielded by it in the infected plots. These data also show that there is no significant difference between the yields of infected

and uninfected plots of Cappelle Desprez, although the yields of all the other varieties tested are significantly reduced by Eyespot.

No Immune Varieties Thus although there were large differences in susceptibility to Eyespot, none of the varieties tested was immune to the disease. Cappelle Desprez showed no significant loss in yield when exposed to infection, but a large proportion of its stems were, in fact, infected by harvest time. This observation is important, because it implies that Cappelle Desprez can carry over or even build up infection from one year to the next on contaminated land, without itself being lodged. It is quite clear, therefore, that although a crop of Cappelle Desprez may be obtained on contaminated land where other varieties might fail, this will not help in any way to free the land of the disease. This can usually be done, however, by growing oats or non-cereal crops for two or three years.

It is not yet known why Cappelle Desprez shows less severe symptoms of attack than other varieties, but this effect is probably due partly to it being less suitable as a host to the fungus, and partly to it failing to lodge when attacked because of its short strong straw. It is not due to the short-strawed character alone, however, as the losses in yield in the infected plots of the short-strawed variety Bersée are nearly as great as those in the infected plots of Yeoman.

Mr. Macer wishes to express his thanks to the Agricultural Research Council for the receipt of a research studentship, during part of the tenure of which this work was undertaken.

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SEAWEED IN ANIMAL FOODSTUFFS

2. FEEDING AND DIGESTIBILITY TRIALS

W. A. P. BLACK, B.Sc., PH.D., F.R.I.C., F.R.S.E.
Institute of Seaweed Research, Inveresk, Midlothian

Last month a résumé was given of the seaweeds likely to be available in quantity around the shores of Great Britain and their potential use in animal foodstuffs, as indicated by chemical analysis. Dr. Black now goes on to consider the more important trials which have been carried out, both in this country and abroad, to assess the actual feeding value of seaweeds.

ALTHOUGH seaweed has been used in animal rations for centuries and many reports on the subject have appeared in the popular press, comparatively few references are available in the scientific literature. An interesting account of its early use in Edinburgh is, however, given in *Sinclair's Husbandry* of 1812 (1). Fresh seaweed fed daily to dairy cows during the winter months was found to improve their health and increase their milk yield. But the earliest recorded scientific trials appear to have taken place in France (2, 3) during the First World War, when the possibility of utilizing seaweed as a supplementary feed for poultry, pigs and horses was investigated. The animals accepted, digested and assimilated the seaweeds. One interesting observation was that the seaweed appeared to remain completely undigested for the first few days of the trial, but after the sixth day no seaweed, as such, appeared in the faeces and the digestibility was excellent.

Trials Abroad Trials in Norway have emphasized the differences which can arise in the nutritive value of seaweed meals, depending on the time of year when it is collected. Lunde (4) conducted feeding trials with rats, pigs, horses and poultry, and showed that the addition of 5-10 per cent seaweed was often very beneficial. Ringen (5) carried out similar trials with pigs and sheep, and tested two proprietary meals, one made from sublittoral weed and the other from littoral weed. The results showed that the nutritive value was exceedingly low, especially for pigs, but that ruminants could utilize the meals better. For the latter, the meal made from the sublittoral weed proved to be superior. Similar work has also been carried out in Eire (6), where digestibility trials with pigs indicated that *Laminaria* meal has a food value about two-and-a-half times that of potatoes, and is intermediate between hay and oats. In addition, by exerting a very favourable action on the alimentary tract of the animal, the seaweed was found to enhance the nutritive value of the original basal ration. Experiments with sheep were also arranged at the Albert Agricultural College in Eire. The most satisfactory sample (*Laminaria*) was that collected in the autumn, but it was only comparable in feeding value to meadow hay (7).

At the Maryland Experimental Station, trials were carried out with dairy cattle (8). Seventy-four dairy heifers were paired according to breed, age and size, and one lot was fed a diet with 4 per cent seaweed meal in the concentrate ration. During the first gestation period there was no advantage in favour of either ration, although calves born to the seaweed-fed animals were, on average, 2.26 lb. heavier at birth than those born to the controls. The trials were continued through a second gestation period, with again no noticeable differences attributable to the seaweed.

Recent trials in Germany ([9]) using a proprietary seaweed preparation (65 per cent *Ascophyllum* meal), showed that it was uneconomical to feed this to fattening pigs, and that, at the 10 per cent level, it was actually harmful to gilts. Tests were also carried out with chickens ([10]). Four groups, each of 40 one-day-old Leghorn chicks, were fed 5, 10 and 15 per cent of the proprietary seaweed meal in their ration up to the age of 8 weeks. With increasing amounts of seaweed, the nutrient assimilation fell from 100 to 95.5 to 95.8 to 95.1, while the weight gains fell from 100 to 91.0 to 84.4 to 80.3. It was decided, however, that as no pure seaweed meal was available, direct conclusions as to its value for poultry feeding were impossible.

Three large-scale experiments with laying hens and chicks ([11]) have recently been carried out in Canada. It was concluded that, while seaweed meal fed at the rate of 2.5 and 10 per cent of the ration had little effect on the performance of laying hens from the point of view of mortality, egg production, eggshell strength, hatchability and body weights, no definite beneficial effects were observed. When chickens were fed on a ration containing *Ascophyllum* meal, substituted for ground oats at the 2.5, 5 and 10 per cent levels, the differences in the mean final body weights were not significant, but at the 20 per cent level growth was slower. It was deduced, therefore, that chickens can tolerate up to 10 per cent seaweed meal in the ration as a substitute for ground oats, but only as an addition to a balanced ration when, for example, soyabean meal is added to compensate for the calculated protein in the seaweed. Sumita *et al.* ([12]) studied the influence of seaweed meal (4-10 per cent of the basal ration) on the iodine content of hens' eggs, and found a marked increase both in the yolks and in the whites. More recent work, however, by Romijn and Lokhorst ([13]), concerning the influence of iodine in the food on the physiological behaviour of the laying hen (one-year-old Exchequer Leghorn × Rhode Island Red), has shown that seaweed in amounts of 5 per cent and over, produced pronounced structural differences in the thyroid gland of the hen without upsetting its metabolic rate. After six months the body weight of the hens fed 5 and 10 per cent seaweed meal was about 6 per cent lower than that of the controls, but the weight of the hens fed 1 per cent seaweed meal was 3 per cent higher than that of the birds fed the standard ration. The hens fed 1 per cent seaweed meal had a shorter moulting period and egg production increased at a faster rate after that period. The iodine content of the eggs from hens fed potassium iodide, and 1, 5 and 10 per cent seaweed meal, increased from 16 to 187, 260, 563 and 903 μg. respectively. It was found, also, that 1 per cent seaweed meal was sufficient to supply all the iodine requirements of an adult man eating one egg a day.

Another trial with pigs took place recently in Canada ([14]). Pigs of comparable breeding were fed barley and tankage, or barley and fishmeal, with up to 6 per cent of the ration in the form of *Ascophyllum* meal. No significant effect was observed with the seaweed meal. The rate of gain was favourable, and the carcass quality of the seaweed-fed pigs was similar to that of the controls.

British Trials In addition to the above, a number of trials have been carried out at various research institutes in Great Britain. The work has been undertaken in conjunction with the Institute of Seaweed Research, and has involved rats, dairy cattle, sheep, pigs and poultry.

RATS To assess the energy value of the four main carbohydrate constituents of the brown seaweeds—namely, laminarin, sodium alginate, mannitol and fucoidin—feeding trials at two different levels of seaweed were

carried out with rats at the Rowett Research Institute. Four male and four female rats were placed on each diet (21 days) and, in addition to a control group, a further group was fed on the control diet of which 8 and 16 per cent was replaced by cellophane. Laminarin and sodium alginate were equal to starch when fed at the 8 and 16 per cent levels, while mannitol and fucoidin, although not statistically significant at the 8 per cent level, were significantly inferior at the 16 per cent level. At a London laboratory ([15]), rats have also been used to determine the biological value of the algal proteins. *Rhodymenia palmata* (dulse) gave a net protein utilization figure of 42, which compares favourably with that of peas (44), and is of the same order as some oil cakes. The rats would not accept the dried, milled brown seaweeds, but *Laminaria cloustoni* frond, when mixed with casein, gave a net protein utilization of 30. An attempt was made, without much success, to extract the protein from *Ascophyllum nodosum*. The small quantity of "crude protein" which was extracted was mainly alginate, and proved to be of little value.

DAIRY COWS At the Hannah Dairy Research Institute ([16]) experiments were carried out to ascertain if the constituents of seaweed were readily utilized by the rumen bacteria and might, therefore, make possible the utilization of any non-protein nitrogenous constituents in the ration. Only laminarin, alone or present in the weed, was utilized as readily as maltose. In January 1953 ([17]), and again in 1954, trials with dairy cows were carried out on selected farms in the west of Scotland. On a number of farms a significant increase was observed in the butterfat content with the introduction of ¾ lb. seaweed meal per cow per day.

At the National Institute for Research in Dairying, Reading ([18]), two seaweed meals (*Ascophyllum nodosum* and *Laminaria cloustoni*) have been compared with oat feed as constituents of the concentrate ration for dairy cows. A delicately planned experiment, using 18 high-yielding Ayrshire cows and with experimental periods each of three weeks' duration, showed that the different diets produced no significant differences in the mean milk yield and percentage of fat, but a slight decrease in the solids-non-fat content was observed when seaweed was fed. No significant differences were observed in the fatness, skin handling properties and chest girth of the cows.

SHEEP Two three-year-old Cheviot wethers have been used at the Rowett Research Institute to determine the digestibility coefficients of four seaweed meals having wide variations in chemical composition. Fed at the high level of 20-24 per cent of the basal diet, the trials consisted of six periods of 12 days each, the first and sixth being on the basal diet. The *Ascophyllum* meal was poorly digested and even had a detrimental effect on the protein in the basal diet, while the *Laminaria* meal (January sample) gave a good digestibility for its crude protein (54.1 per cent) and N-free extractives (71.8 per cent).

PIGS Digestibility trials with the same seaweed meals used in the sheep trials were also carried out with pigs at the Rowett Institute. In general, the results show that, as with sheep, the digestibility of *Ascophyllum* meal is considerably lower than that of the *Laminaria* meal. The *Laminaria* meal, however, gave a good digestibility for N-free extractives (88.5 per cent), but a low digestibility for crude protein (7.1 per cent). Group comparison feeding trials (with two lots of five pigs) at the Edinburgh and East of Scotland College of Agriculture showed that *Ascophyllum* meal could be introduced into the diet without affecting the growth rate or quality of the bacon. The meal was used to replace 5 per cent of barley meal on a lb. for lb. basis

when the pigs weighed 50 lb., was increased to 12 per cent at 90 lb., and was then fed at this level up to bacon weight. No taint was discernible in the bacon from the seaweed carcasses, which were of excellent quality. Although the food conversion ratio was greater when seaweed was fed, it was considered that it might still be economical to use it as a source of carbohydrates.

POULTRY Experiments at Reading University were designed to find the level at which seaweed can be fed to one-year-old laying pullets without upsetting their mineral metabolism. Three seaweed meals—two of *Laminaria* with high and low ash contents, and one of *Ascophyllum*—were fed to four Rhode Island Red pullets. The experiment, which lasted in all for 80 days, was divided into five periods of 16 days each. The replacement of 10 per cent of the basal ration by an equal weight of any of the three seaweed meals had no ill-effects on the birds; egg production was maintained and the birds remained perfectly healthy. More water was, however, drunk by the seaweed-fed birds, and there was a marked increase in the chloride content of the droppings. On the other hand, it was found that 20 per cent of seaweed meal, when fed in conjunction with a mineral supplement, upset the metabolism of the birds. These short-term trials (16 days) were followed by a 200-day trial, also with one-year-old Rhode Island Reds. For the first 100 days, 10 per cent of their basal ration was replaced by the seaweed meal, and this was increased to 15 per cent for the second 100 days. The results confirmed the earlier ones that 10 per cent of seaweed meal can be fed without any detrimental effects.

In all the poultry trials it was noted that the seaweed definitely increased the palatability of the ration, but had little effect on the colour of the egg yolk. Experiments carried out, first at the Edinburgh and East of Scotland College of Agriculture, and later at Fairview Poultry Farm, Edinburgh, showed that 5 per cent *Ascophyllum* meal could supply all the vitamin A requirements of the bird from day-old up to 16 weeks of age, while the seaweed also had an antirachitic effect. These results have been confirmed by later trials at the National Institute for Research in Dairying, where experiments have also been carried out with chickens to assay the vitamin B_{12} contents of different species of seaweed.

Trials at Fairview Poultry Farm have also indicated that 3 per cent *Ascophyllum* meal can be used to replace the same amount of grassmeal normally included in the poultry ration to give the standard yolk colour to the eggs.

Limited Use for Pigs, Poultry and Dairy Cows The results of feeding trials so far carried out are not in accord, but this may be due to the seasonal variation in composition of the seaweed, the varying composition of the basal diet, and differences in the intestinal microflora of the test animals. In some trials the seaweed has been found to have a detrimental effect on the protein of the basal diet, causing it to be carried through the alimentary tract unchanged, but in these instances the trials have been of short duration and the results are consequently of limited value.

With pigs, seaweed can be introduced up to 10 per cent of the basal diet without affecting the growth rate or the quality of the bacon, and with high-yielding dairy cows 10 per cent of their concentrate ration can be replaced by seaweed without any noticeable effect on the milk yield or butterfat content, although on many farms 8 oz. seaweed meal per day during the winter months has resulted in a marked increase in milk yield and butterfat. With day-old chicks, up to 5 per cent seaweed can supply all their vitamin A

and D requirements, and with laying hens 10 per cent of the basal diet can be replaced by seaweed without any detrimental effect. When seaweed has been fed to laying hens and dairy cows, very marked increases in the iodine content of the eggs and milk have been obtained. Since, however, noticeable effects have been obtained by the introduction of as little as 1 per cent seaweed in the diet, the beneficial results would appear to be due to trace elements, vitamins or growth-promoting substances active at low concentrations.

In many of the trials no beneficial effects have resulted from the inclusion of seaweed, but it must be borne in mind that in most of these cases the seaweed has replaced an equal amount of a carefully balanced diet which could not possibly be improved by any supplement. On economic grounds, the substitution of seaweed meal for the basal ration may, in many instances, be advantageous. In time of war or scarcity it certainly means that the animal population could be maintained on a proportionately smaller amount of cereals, or alternatively, that the animal population could be increased for the same amount of cereals.

In other countries the value of seaweed meal in animal foodstuffs appears to have been already accepted. For example, in Eire it must, by law, be incorporated at a low concentration in many of their standard foodstuffs. In New Zealand seaweed meal has benefited cattle grazing on mineral-deficient pasture land, while in America a great improvement in the health and fertility of cattle and chicks has been noted when seaweed has been fed at low concentrations. In France, also, 10,000 tons of seaweed meal go every year into cattle foods, while in the British Isles the industry, although still in its infancy, sells 7,000 tons a year.

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SELECTIVE WEED CONTROL IN DIRECT-SOWN LEYS

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Recent work at Hurley points to the value of an early spraying with dinoseb to control the more common weeds occurring in direct-sown leys.

ONE of the most serious problems associated with the establishment of leys by direct seeding, without the use of a nurse crop, is the smothering effect of annual weeds. Quick establishment can generally be achieved by bringing in the grazing animal as early as possible, usually not later than the sixth week after sowing. A heavy concentration of stock should be used to cut off the herbage as rapidly as possible. By repeated grazings at intervals of 2-3 weeks, a new ley can be well established by the end of the first season. The mowing machine can be used to cut down weeds and roughage.

But although grazing and mowing together effect a measure of control, there is often anxiety when grass and legume seedlings are covered with a dense canopy of weeds. This is particularly the case on land infested with chickweed (*Stellaria media*), knotgrass (*Polygonum aviculare*) and other low-growing, spreading weeds which the mowing machine will miss, or with a dense covering of upright weeds; particularly those, such as mayweed (*Matricaria* spp), which are unpalatable to the grazing animal. A herbicide for chemical control would be extremely valuable in these circumstances, and for this reason an investigation into the potential value of 2:4-dinitro-6-secondary-butylphenol (dinoseb) was begun in 1950. A research report on these experiments was presented in 1953*, but the work has been continued and has been supported by field-scale spraying in each of the years up to and including 1954.

Results indicate that grasses are resistant from a very early stage of development, and may be sprayed at the 3-5 leaf stage with one developed tiller. Some leaf scorch will occur, but a dense weed cover has a greater depressing effect than dinoseb even at 9 lb. per acre (over three times the recommended rate). The results also show that alsike clover (*Trifolium hybridum*) and sanfoin (*Onobrychis sativa*) are resistant at the 1-2 true leaf stage; white clover (*Trifolium repens*) is less tolerant, but may be sprayed at the 2-3 trifoliate leaf stage. Red clover (*Trifolium pratense*) and lucerne (*Medicago sativa*) are both subject to severe scorching, but recover quickly and may be sprayed at the 4-5 true leaf stage.

* Selective Weed Control in Seedling Grasses and Legumes with Ammonium Dinitro Secondary Butyl Phurate. F. E. Alder. *Proc. British Weed Control Conf.*, 1953, 144–52.

Good Control with Dinoseb The concentration of spray, applied at the rate of 80-100 gallons per acre, should be between 0.1 and 0.3 per cent (1-3 lb. dinoseb per acre). The actual rate of application will depend on the legume sown, the stage of plant development, and the prevailing weather. The concentration must be reduced if rain has fallen or humidity is high, and should be reduced as the temperature increases above 60°F. For example, 1.5 lb. dinoseb per acre sprayed on white clover in the 2-3 leaf stage could be safely used up to 65°F. in fairly dry conditions, but in similar conditions red clover would receive a severe check if this spraying rate were used. To obtain adequate weed control, spraying must take place as early as possible consistent with crop resistance. Many of the poor results obtained with dinoseb spraying have been due to delaying the operation. The main value of dinoseb lies in the fact that it is effective against many of the weeds which are resistant to the growth-regulating herbicides (MCPA and 2,4-D). Many of these are the weeds which should be controlled—for example, chickweed.

The value of chemical control may be demonstrated by citing two instances where the spraying has been of value in the field. In the first, a stand of red clover for seed production, sown on May 10, 1954, became infested with weeds, the chief of which were poppy (*Papaver rhoeas*) and knotgrass. The area was sprayed on June 23 in dry conditions with a temperature of 65-69°F. and a humidity of 79 per cent, using 1.5 lb. dinoseb per acre. Good control of poppy and moderate control of knotgrass was obtained, and although the red clover was scorched, it recovered well and thrived with the reduced weed competition. A yield cut, taken from the area on October 8, gave 1,000 lb. dry matter per acre with 67 per cent red clover.

In another instance, a perennial ryegrass/white clover ley, which would not be grazed because of the nature of the experiment, was badly infested with runch (*Raphanus raphanistrum*). The clover was in the 1-2 trifoliate leaf stage, while the runch was 4-5 inches tall when spraying took place on October 7, 1954. Dinoseb was sprayed at 1 lb. per acre in 67 gallons of water on a dry day with a maximum temperature of 53°F. and a relative humidity of 84 per cent. At least 75 per cent of the runch was killed and the rest badly scorched. The ryegrass and white clover plants were not damaged and have developed into a good sward. In all our field spraying the spray pressure has been maintained at 60-80 lb. per sq. inch.

Among the great values of early spraying are that it allows for quicker establishment of the sown species, and for the use of low seed rates on weedy land. In addition, with spring sowings the seedlings are less liable to damage if a hot summer should follow. The better establishment helps to prevent a quick ingress of *Agrostis* and other grass weeds. It is not necessary to achieve complete control, particularly where aggressive species such as perennial ryegrass and white clover are sown. The young sward should be grazed 3-4 weeks after spraying to control any remaining weed, and subsequent grazing should follow at intervals of 2-3 weeks, since treading will help consolidation, and defoliation will aid tillering.

The one drawback to the use of dinoseb is the care required in handling the material. It is a poisonous substance and care should be taken to observe the precautions required by the Regulations made under the Agriculture (Poisonous Substances) Act, 1952. If this is done, the dangers of poisoning by absorbing dinoseb can be avoided. But despite this, of all the herbicides at present available, it is the one most likely to be of value. It may be superseded in time by 4-chloro-2 methylphenoxybutyric acid (MCPB)—a herbicide which is safe to apply on clovers. But the weeds which need controlling—mayweed, cleavers and chickweed—are resistant to this chemical.

ECONOMIC FARM BUILDINGS

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The true cost of a farm building is the initial cost of erection plus maintenance. And maintenance can be expensive. With this in mind, the Department of Estate Management at Cambridge recently carried out a survey to find out the main causes of dilapidation and to decide which building materials are the most economic in the long run.

BRITISH farmers are nowadays being called to look much more to their account books, for success in the future will undoubtedly rest with those who know the secrets of economic efficiency. And in achieving this, economic farm buildings, like sound marketing and wise organization, will be indispensable. Unfortunately, it is not easy in the matter of buildings to tell the profit-makers from the profit-takers. Brick or timber, steel or stone, concrete or cob, this type of construction or that—the choice is wide. To make matters worse, the choice often appears too simple, as if the cost of putting up a building were the only test of economy. The wise man, however, knows how the cost of upkeep or maintenance is every bit as important as the outlay on construction. The two must go together.

The show-stands and advertisements designed to help the farmer with his farm buildings' problem tell little about maintenance costs. This, however, is not really so reprehensible, because little is known of the subject. An attempt has therefore recently been made to meet the need for more information about the maintenance costs of simple farm structures and to show how they can be linked with costs of construction to give standards of building economy. This work was a logical step from the study of the problem of providing implement accommodation, made by the Department of Estate Management at Cambridge University in 1953. Like the earlier work, this second phase was instigated by the Ministry of Agriculture. Some of the results of this novel survey may be of practical worth to those who are preparing budgets for future capital improvements.

Maintenance is a continual fight against deterioration, decay and damage. The fight can be waged either by making good the disrepair and dilapidation as it occurs, or by preventing it as far as possible by using proper building techniques. For the purpose of this survey, prevention was the better starting point. Disrepair may be incipient or far gone. Costs of remedy vary greatly, and would have been of little use in a pursuit of common principles as guides to maintenance costs. Accordingly, field investigations were designed to find out what defects occur in buildings, why and how they are caused, and the cost of preventing them. Buildings of many types in different areas were selected, and in this way a study was made of the significance of both environment and structure.

Twelve Causes of Dilapidation Dilapidation can be the evil consequence of more than one cause. Indeed, disrepair leads to disrepair. For example, defective guttering can cause wall damage and wood rot, and aggravate the ills of poor site drainage.

The survey identified twelve major causes of defect in simple farm buildings, as listed opposite. These causes were referred to as contributory agents. Of them all, exposure occurred most often. The consequences of exposure

seemed to be most severe among the buildings surveyed in industrial, upland and seaboard areas, but even in sheltered plains and open fen country exposure was a cause to be reckoned with.

Causes of Dilapidation

Exposure	Soil or vegetation encroachment
Faulty design	Subsidence
Faulty structural work	Lack of preservative*
Faulty repair work	Tree proximity
Faulty painting	Percussion
Improper use	Poor materials

There were two prominent underlying causes of trouble in addition to exposure—lack of preservative and faulty painting. Exposure is a predisposing cause that cannot always be avoided, but these other two mischief-makers can be controlled by care and thought. A common form of carelessness was the neglect of new steelwork: a red oxide primary coat applied by the manufacturers to the components of steel framework was expected to do the service of three coats of paint. Failure to use creosote, or some other wood preservative, is an invitation to woodworm to destroy the stout and petty timbers of buildings. The frequency of poor paint workmanship raises the question of the desirability of employing farm labour on farmstead maintenance. A good ploughman is not necessarily a good painter. It is tempting to think of painting as a foul-weather job for idle hands, but skilled craftsmanship is wanted. Good paint slapped over rain-soaked guttering means time and material wasted. So, also, does good paint applied to surfaces ill-prepared, or a new coat placed over an old coat of incompatible temper. The importance of skill in maintenance work and construction was further borne out by the fact that faulty repair and structural work were two predisposing causes which also occurred frequently in the evidence of the survey.

Another trouble-maker calling for attention was soil and vegetation encroachment. Trees and bushes too close to buildings can cause damage. Trouble of this kind was most noticeable among buildings in sheltered plains, but it was not peculiar to situations of that kind. Chronic dampness from soil banked against the walls of buildings is common in uplands, especially near the sea, where foundations are too often cut into the hillsides and the building snuggles into the contour of the hill away from the track of off-sea winds. This solution may be more disastrous than the trouble it seeks to avoid. The lashing of a sea-soaked wind does not last for ever, but the percolation of water from sodden soil can be an insidious evil.

Twenty-two Major Defects Turning from the causes of dilapidation, we can now look at the defects which resulted from them. These defects were in fact, more numerous than the agents previously listed. In all, twenty-two were recorded in the survey:

Poor site drainage	Poor pointing
Structural failure	Gutters and spouting ineffective
Structural cracks	External sheet rust
Defective paint	Internal sheet rust
Woodworm	Frame rust
Rot	Breakage
Warp	Roof cover deficiency
Shakes	Decay of tiles, slates and asbestos
Opened joints	Water penetration
Decayed bricks and stone	Nail sickness
Damp retention	Torching

* Paint was regarded as a form of preservative on timber.

Twenty-two ailments of walls and roofs is a startling list, but, fortunately, every building was not prone to all. Nevertheless, two of these defects were found in all types of buildings. The ubiquitous faults were inefficient gutters and spouts, and poor site drainage. Normally the busy farmer might be excused for paying little attention to minor matters of this sort. But, like the common cold, they can lead to radical trouble if neglected. Ineffective guttering can be the cause of malignant conditions in which rot and rust become prevalent.

As would be expected, defective pointing was widespread among the brick and stone buildings. Rot was characteristic of stone-walled structures on the seaboard. Faulty paint occurred most often on steel-framed structures with iron-sheeted walls. Timber frames and iron sheeting did not suffer so much in this way but, like steel and iron sheeting, they were vulnerable to internal sheet rust. It was remarkable that buildings of timber and iron sheeting appeared to be less vulnerable than those of steel and iron sheeting to external sheet rust. Old timber and weatherboarded buildings suffered more from rot but less from shakes in main timbers than timber-framed buildings carrying iron sheets.

The survey showed that the chief defects of roofs were breakage, woodworm, roof cover decay, and rust. Woodworm attack was more severe in the timbers of roofs with traditional roof coverings of slate or tile than in the timber and sheeted roofs. Cover decay and breakage were of more consequence in slated than in tile and asbestos roofs. Nail sickness was a defect prominent among the slated roofs, but had little or no significance in other types. On the other hand, timbers under tiles suffered more from opened joints than did those under slates.

Finding a Unit of Comparison for Maintenance Woodworm and frame rust were outstanding defects of both walls and roofs. These and the defects just mentioned therefore provided a groundwork for the estimation of maintenance costs. The several buildings were considered in turn, and the cost of preventing these primary and secondary defects was calculated. Defects common to all types of buildings were omitted from the calculations, because what was wanted was a set of relative costs showing how the maintenance costs of buildings of differing structure compared with each other: that is, how brick compared with steel and iron; how asbestos roofing compared with slates; and so on.

Maintenance work has, of course, to be done regularly, but the span between jobs varies. Thus some operations are due every three years, while others recur at five-yearly intervals. The longest cycle is the twenty years between treatment of woodwork against woodworm. Calculations were accordingly based on this longest period. Maintenance costs over twenty years were worked out and divided by twenty to give an average annual figure.

A practical difficulty was finding a unit of comparison. There was no point in comparing building with building, since a large building obviously costs more to maintain than a small one, other things being equal. The problem was to make the evidence collected from a great variety of sizes and designs show which of many different forms of construction was the cheapest in upkeep. No matter what the size and shape of a building may be, its dimensions can be given in so many linear feet, super feet, or cubic feet; that is to say, in terms of a common unit of measurement. Here was the key to the solution of the problem. Maintenance cost could be expressed not as the total cost for the building, but as so much per common unit. In this way, comparison would be possible.

Walls were treated separately from roofs. A unit common to all buildings is a square foot of floor area. This was a possible unit of comparison, but it suffered from the defect that the total cost of maintenance depended upon the amount of walling in a building, and two buildings with exactly the same floor area could have different extents of walling. Consequently, it was decided to take both the area of floor space and the area of walling into account. The total maintenance cost of each building was therefore divided by the number of square feet of floor area and walling area, and the resultant figure was called the "maintenance coefficient" of the building. By comparing the figures obtained, it was thus possible to arrange the buildings in order of economic merit.

Maintenance coefficients for roofs were worked out on a similar principle. Maintenance cost per square foot of floor area was divided by the number of feet in the roof span. It was necessary to do this because the cost of roof maintenance is governed, among other factors, by the extent of the roof span, and two buildings of equal floor area can differ in roof span.

Adding Construction Costs To find out which type of construction was the most economic the cost of maintenance had to be linked up with the cost of erection. The two could not be simply added together. Maintenance is a continual outlay; erection a once-and-for-all expenditure. One is a charge on revenue, the other on capital. Either maintenance cost had to be translated into capital terms, or erection cost translated into terms of yearly expense. The second alternative was adopted. When a farmer puts up a building he locks away capital. The building is costing him each year the interest he would have got had he invested his capital elsewhere, or the interest he has to find on the money borrowed to pay for the building. Interest on the cost of erection is therefore a way of expressing the cost in terms of a yearly commitment. This was the method used in the survey. An interest rate of 5 per cent was thought to be reasonable.

The yearly interest figure for each building was worked out; walls and roofs were separated as before and the method used for reducing total maintenance costs to comparable units was again adopted. The results revealed how the costs of erection compared with each other. And because they were figures of yearly commitment, they could be added to the maintenance coefficients to give a grand series of measurements. These measurements were called "construction-maintenance coefficients". They showed at a glance which type of structure was the most economical.

The Most Economical Structures The story which the construction-maintenance coefficients told can be illustrated by the following two lists for roofs and walls, in which the different types of structure are arranged in a descending order of economic virtue:

Wall Structures	Roof Structures
Brick	Steel and asbestos-cement
Steel and corrugated iron	Timber and asbestos-cement
Timber and asbestos-cement	Steel and corrugated iron
Brick, steel and corrugated iron	York board
Timber and weatherboard	Timber and slates
Timber and corrugated iron	Timber and corrugated iron
Concrete	Timber and tiles
Concrete, steel and corrugated iron	Steel and patent metal
Stone	

The economic virtue of these structures depend upon the rate of interest used when calculating the annual equivalents of the costs of erection. A

rate of 5 per cent was used because history shows that landlords seldom expect a higher return on money put into land and buildings. A tenant farmer, however, may look at things differently. He would probably have to decide between putting capital into his farming stock or into a new building. Invested in farming stock the money would probably bring a much greater reward than 5 per cent, and therefore this higher rate of interest, whatever it might be, would determine for him the yearly equivalent of the cost of erection. In his eyes, the sequence just given would not be the true order of economic preference. What the actual order was would be decided by circumstances, but, as a general rule, structures with high maintenance and low erection costs would be preferred by him. On this principle, it is possible to give two sets of sequences; one for what may be called buildings of landlords' preference (as shown on the previous page), and the other for buildings of tenants' preference, thus:

Wall Structures	Roof Structures
Steel and corrugated iron	Steel and corrugated iron
Brick	Steel and asbestos-cement
Timber and asbestos-cement	Timber and asbestos-cement
Brick, steel and corrugated iron	York board
Timber and weatherboard	Timber and corrugated iron
Timber and corrugated iron	Timber and slates
Concrete	Timber and tiles
Concrete, steel and corrugated iron	Steel and patent metal
Stone	

COMMERCIAL CHRYSANTHEMUM GROWING

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Mr. John Stevenson, who is a well-known chrysanthemum grower in the south of England, considers some of the commercial production methods used today, with particular reference to those he has found most successful on his own nurseries.

According to the latest statistics, chrysanthemums occupied 794 acres of glasshouses in November 1954; that is, more than four times the acreage of any other flower crop. Two factors contribute to this popularity. The most important is that the chrysanthemum is an excellent florist's flower and a profitable one for the grower: the second is that it can be grown as a catch crop to occupy the glasshouses after the tomato crop has been cleared. In consequence, there are commercial cut-flower chrysanthemum crops in the open and under glass in most parts of Great Britain, from the Caledonian Canal southwards, and they form by far the major item in the flower markets from mid-August until the first week in January. There are some who would like to see them in the market the whole year round, as is now the case in the United States and Canada, but in my opinion the season is long enough, even too long. Indeed, I am not at all sure that the "all-the-year-round" chrysanthemums are very popular in North America.

The chrysanthemum is mainly thought of as a cut-flower crop and little is heard about the enormous business that is done in plants and cuttings,

both to the trade and to amateurs. There is also a considerable export trade in cuttings and plants, particularly to European countries, although there is a demand for British stock in all countries where chrysanthemums are grown. With the spread of air transport, they can now be delivered safely within a week to almost any part of the world.

The raising of new varieties and their distribution is another very important facet of the work, and British raisers are among the best in the world. However, the very notable contributions that have been made in this field by raisers in Australia and the United States must not be forgotten. Some of them may not have had the recognition outside their own countries that they deserve.

But from the point of view of the annual turnover and the labour employed, the cut-flower side of the industry is the most important. As a florist's flower, the chrysanthemum is almost ideal. It offers a wide selection of colours and form and is usually a good keeper. Unfortunately, the use of the plant as an indoor catch-crop does lead to the production of a lot of inferior flowers, and there is probably a bigger range in quality than in any other cut-flower crop. Whilst reasonable quality can be produced by almost any grower, the top quality can only be expected by those who look upon the chrysanthemum as the main crop and give it all the attention which it requires to come to perfection.

It is not possible in a short article to go into much detail about cultivation, but perhaps an outline of the main methods used may be of interest. More detailed information can easily be obtained from the many publications on the subject.

Earlies are Profitable The simplest of the chrysanthemums to grow, and perhaps the most profitable, are the earlies—that is, those that flower in the open from mid-July to the end of September. In many parts of the country they can be grown satisfactorily without any protection from frost. Given some slight protection, the season can usually be extended to the end of October, but this is a little risky, for without artificial heat unusually severe frosts may damage the flowers, while in mild weather there is danger from *Botrytis*. Damping of the petals caused by *Botrytis* was particularly severe in some areas during 1954. Personally, I plan to finish the earlies in September and to make a start with indoor varieties in October.

The soil at Colham Green is brickearth, which is ideal for chrysanthemums, and possibly for most crops that mature in late summer and autumn. This fact should be borne in mind when considering the following comments on outdoor cultivation. It is of less importance in the other methods.

The target to aim at with the earlies in the open is a crop of 10-12 blooms per plant. For this, early propagation is important (late January or early February), and it is essential to plant out good plants as early as weather permits. At Colham Green this can usually be done at the end of April or early May. There is a risk of May frosts, but in twenty-seven years we have had no trouble from frost, so the danger can virtually be discounted. The ground should be well worked and manured. Double digging, with 50 tons of dung to the acre, is perhaps the ideal. If hand digging is not possible, there are some very good deep-digging reversible ploughs, which, although they will not do such a good job, offer perhaps the best substitute that can be afforded today. Unless the soil is definitely deficient in any particular plant food, animal manure and lime should be the only additions needed.

Planting is best done in three-row beds, at 14 inches square. The paths between the beds should be at least 2 feet 8 inches wide. This spacing will give about 15,000 plants per acre.

Early chrysanthemums can also be a useful crop to occupy the houses from April until September, when the late varieties are brought inside. Treated almost the same as the outdoor crop with regard to soil preparation and spacing (except that the paths can be narrower), a good crop can be obtained flowering any time between mid-July and the end of September. Most varieties will flower about the same time, whether grown under glass or in the open. For the early part of this period it is as well to concentrate on white and yellow varieties, since the pinks, reds and bronzes will fade in hot weather. Tomato enthusiasts would consider this a gross misuse of glass, but the chrysanthemum specialist thinks otherwise.

Differing Methods with Midseason and Late Varieties There is no doubt that the best way of of producing first-class midseason and late chrysanthemums is the well-tried method of using up to 12-inch pots for the final potting. For the best results, January-early February propagating is needed. You can then expect 10-12 blooms from a single plant in a pot. It is no good attempting this pot culture from early propagating unless labour is available to do the intermediate pottings at the right time. It is really a method for the specialist. The same varieties can be grown in pots from late-propagated plants and potted direct into the big pots, two or three together, as late as the end of June. Good, but not the best results, may be obtained in this way.

The potting method can be used for almost any variety flowering from October onwards. It may be more expensive than other ways, but the magnificent results obtainable still justify the expense for at least a proportion of the crop. There is always a demand for flowers that are just that little bit better.

One of the most popular and, it has been said, the most profitable practice, is to grow varieties flowering from October onwards planted out in the open, to be dug up and taken into the houses when the tomato or other summer crop is cleared. This method is called "lifting", and the lifting operation usually takes place at the end of September or early October—a time when the plants are at a critical stage in their development and need the full output from the roots. I have never practised this method and thus can say little about it. No doubt there are good lifted crops grown by the more careful growers, but generally speaking the method does produce some of the worst samples of flowers seen on our markets.

Alternatives to Lifting Late-flowering varieties can be rooted late and potted into 5-inch pots about mid-June, grown outside for six weeks, and brought into the houses following a crop of gladiolus, early tomatoes, or any other crop that finishes by the end of July. The plants can be plunged or planted, and should produce four or five blooms per plant. Spacing should be about 12 inches square. This method could be modified to allow planting up to the end of August. The earlier plunging or planting will give very high quality flowers; the latter will give small flowers but still good quality that will sell well at the end of the year. Some tomato-growers are planting late to replace lifting and the practice is certainly giving better quality blooms. They find that it is paying to sacrifice the tail-end of their tomato crop, since the chrysanthemums which follow are of better quality and they are more valuable than

the lifted crop which would be brought in later. November- and December-flowering varieties are best for this particular purpose.

Some chrysanthemum specialists are finding that October- or early November-flowering varieties are a good crop to grow planted in the houses. Planting can take place in early May at about the same time as the varieties would have been potted into final pots. In fact, the best way to treat these plants is just the same as for pot work, but the final move is into the ground instead of to the 10-inch pots. Early May is the best time for planting if the houses are high, for many varieties will grow to six feet or more when under glass. For lower houses, planting can be done later, but then more plants will be needed to produce the same crop of flowers. Planted in May, the spacing will be 15-18 inches square; for later planting, possibly 12 inches square would be sufficient. It is not wise to plant late varieties in the houses in May, for they will grow too soft and too tall. Leave the planting of these until July.

Growers with movable structures can raise midseason chrysanthemums in the ground outside, to be covered by their movable structures before frost is expected. If no artificial heating is available in these houses, then the choice of varieties is rather limited. It will be necessary to select varieties flowering as soon after the end of September as possible, for with the exception of the favoured south-western and south coastal districts, there is always a risk of frost damage in October. If artificial heat is available, then the choice of varieties is much wider.

Pests and Diseases There are many insect pests that may attack chrysanthemums, but all can be controlled by one, or perhaps a combination of two, of the well-known insecticides. A combination of nicotine and DDT is both safe and reliable to control all insects that attack the chrysanthemums, with the exception of Red Spider, *Tetranychus telarius*. (Technically spiders are not insects.) If chrysanthemums are grown under glass throughout their entire season, spider can be troublesome, and in these circumstances parathion is no doubt the only real cure.

On some holdings, eelworm (*Aphelenchoides ritzema-bosi*) may be troublesome, particularly on the early-flowering varieties. This pest can be reduced considerably by deep cultivation to permit good drainage and assist the development of a healthy root system. It is essential to ensure that no chrysanthemum residues are dug into the ground after the crop is finished, and the grower should also plan his rotation very carefully. It is unwise to plant the same variety two seasons running on the same piece of land. If eelworm attacks are heavy, the stock must be cleaned up by warm-water treatment of the stools: afterwards, regular parathion spraying should keep the plants healthy.

Chrysanthemum Rust (*Puccinia chrysanthemi*) is sometimes troublesome, but again this is often due to faults in cultivation, for anything that interferes with the steady growth of the plant will cause outbreaks of rust on susceptible varieties. The most usual causes of these attacks are lack of balanced feeding and overwatering sufficient to upset root health.

Of recent years much has been heard about viruses, and the chrysanthemum grower has been particularly interested in the virus causing "flower distortion". I think it unfortunate that any distorted or discoloured flower is now considered to be caused by a virus, particularly since this attitude of mind has lead many growers to destroy stocks which were probably quite healthy. Where virus *is* the cause of the trouble, careful selection of stock should soon be effective in cleaning up the infection. This distortion has been known for years, and one of my earliest jobs in a chrysanthemum

nursery was the regular inspection of all the flowering plants to eradicate those giving distorted flowers. If we were all equally careful about this I am sure flower distortion virus would no longer be a menace, even if it were not entirely eradicated. There is much flower distortion and discoloration which can be due in part to bad cultivation, insect damage and to variations in temperature. Today much is being discovered about the conditions under which chrysanthemum buds are formed, and it is becoming more and more apparent that temperature has a very big effect on the formation of the bud and of the type of flower that will be produced from that bud. Even slight variations of temperature have their effect, and extremes of temperature, both high and low, do have a tremendous crippling effect on the flowers.

The Best Varieties I am often asked to indicate what I consider to be the best varieties for the commercial grower. I am therefore giving below two lists of those which I would recommend. They merely include those I have found to be worth while. I do not, of course, claim that these lists are comprehensive.

Early-flowering Varieties

(Those marked with an asterisk are also very good under glass)

Balcombe Brilliance	Drift*	Peak Pearl
Balcombe Yellow	Film Star*	Radar*
Brighton Yellow* (not good outside at Colham Green)	Fred Yule	Red Flare
	Harold Park*	Sanctity*
Brumas	John Woolman*	Serenus
Chatsworth	Leader*	Sunbeam*
Cotswold White	Moonbeam*	Sweetheart
Delamere*	New Princess	White Hope Valley
Delightful*	Peach Blossom*	

Midseason and Late Varieties

With the exception of Harold Alston, all are suitable for growing in large pots. Those marked † are very suitable for planting under glass or flowering under movable structures. Those marked ‡ are good for growing in 48s to plant or plunge in the houses at the end of July or early August. Also to be recommended are any sports of these varieties.

American Beauty‡	Favourite‡	Mayford Supreme†
American Spartan‡	Friendly Rival‡	Princess Anne†
Balcombe Perfection†	Harold Alston†	Rose Harrison‡
Celebrity†	Indianapolis Pink‡	Shirley Late Red†
Chairman†	Jamboree‡	Snowcap†
Crensa	Loveliness†	White Progress†
Crimson Robe‡	Marie Morin†	Winn Quinn
Downs Beauty	Mayford Royal	
Finale	Mayford Crimson†	

STRAWBERRIES FOR MARKET

G. H. STANSFIELD, B.Sc.(Hort.)
Ministry of Agriculture, Fisheries and Food

A little extra care in picking and presenting strawberries can be more than repaid by the higher prices which the product will attract in the market.

SOME of the strawberry consignments offered for retail sale in this country are deplorable. There is no excuse for bad marketing, for no crop offers greater rewards for care in picking and good grading and presentation in the freshest possible condition than the strawberry. The view of some growers that it is too difficult, uneconomic—even impossible—is just unrealistic. It can be accomplished whilst keeping up an output almost equal to picking the berries as they come, and the slight extra cost is more than recovered by the higher prices which well-graded strawberries always command.

To grade or not to grade must, of course, be the grower's decision, depending upon the quality of his crop and the extra work entailed to market the berries as "Extra Selected". But even if the crop is not worth the trouble of making up into two grades, it can still be profitable to practise some selection.

Careful Picking A good crop can be spoiled by bad picking, so the supervision of the picking gang is very important. On small gardens the grower himself supervises, and usually spends his time between the packing-shed and the field. Larger acreages call for supervision by the quantity checker—either the general farm foreman or a supervisor especially delegated for the job. Most of the labour will be local. Farm workers' wives welcome the extra money, and casual labour from nearby towns will make up the balance. Children do not make good pickers.

The supervisor will assign the rows to the pickers, ensure that no ripe berries are left unpicked, no green or immature berries are placed in the containers, and that the pickers do not trample on the rows of plants. The best way of picking is to travel along between the rows and pick from the plants on either side, rather than to straddle a row and pick from both sides of the same plants. The dependability of the pickers determines the number that can be supervised by one man. In general, a labour force of up to fifty can be controlled by one supervisor.

It is usually necessary to pick over an area of strawberries every two days, although bad weather may interfere. The proper stage of ripeness for picking depends upon the variety, whether the fruit is required for the fresh fruit market or for processing, and the distance to market. Naturally firm varieties can be left until quite ripe, but others soften quickly and must be picked at an earlier stage to reach the market in good condition. Fruit required for processing can be allowed to ripen more fully; this also assists the "plugging" of the berries. Variations in colour detract from the appearance of a container of strawberries. Although there are bound to be such variations, they can be kept to a minimum by careful supervision to provide a more uniform product. A well-coloured, uniform sample of strawberries will always sell better than those of poor colour with large variations.

Strawberries should be picked by pinching off the stem with the thumb

and forefinger, leaving about half an inch of stem attached to each berry. The severed berry should be placed carefully in the container. The four corners of the containers should be filled first, placing the calyx end towards the corner. The rest of the container may then be filled with berries carefully placed in position. There is always a tendency, especially for those on piece rates, to handle the berry between finger and thumb, to hold several berries in one hand, and then toss them into the container. The containers should not be overfilled. It is easier to fill a container to correct weight later on, but having to remove fruit involves excessive handling and consequent bruising.

Crediting pickers for work done depends upon the system of collecting the fruit from the field and taking it to the packing-shed and the method of payment. If the workers are on piece rates of pay or on daily rates plus a bonus per lb. for the amount of fruit picked, then a system of checking the amount picked must be devised. If the field is close to the packing-shed it is better to let the pickers carry in their own produce and have it checked there for quality and quantity. This enables the pickers to "straighten their backs" and often results in more work. If the fruit is collected from the field by a separate worker, then numbered trays or carriers must be used so that the picker can be credited with the amount picked. An alternative system is to use tokens, which are later exchanged for cash.

Carriers or trays for conveying the market containers into which the fruit is packed vary in size and shape, but they should be substantially built, light, easily balanced, and the containers should fit in them snugly. The picked fruit should not be left exposed in the field; each tray should be taken to the packing-shed as soon as it is filled.

Grading for Higher Prices Strawberries may be graded in the field by picking one grade at a time, or by putting the grades into separate containers during picking; or they may be selected after picking. Picking one grade at a time requires two gangs of pickers, the first picking the top-grade fruit and the second following to pick the remainder of the crop. The second gang, unless it consists of regular farm workers, should receive an extra bonus to compensate for any loss of earnings.

The only method which can be recommended for grading in the field is to pick the grades into separate containers, and this is simplified by the fact that the grades are usually marketed in different types of containers (for example, 1 lb. chip punnets for top grade and 2 lb. chip baskets for the lower grade produce).

The method of picking the crop for later selection in the packing-shed can be recommended only if conscientious and thoroughly reliable workers are used in the shed. This method is particularly suitable for picking high-quality fruit grown under glass. In this case, the fruit from cloches or frames is picked into single layers and laid in trays lined with wadding.

Careful handling, good grading and presentation all combine to achieve the best market prices. To improve the marketing of home-grown strawberries, the Marketing Division of the Ministry, acting on the advice of its Advisory Committee on Standard Grades and Packs for Fruit and Vegetables, which is representative of all sections of the horticultural industry, has recommended grades and grade definitions for use by growers and packers.*

* Details of the grade designations and quality definitions are given in Marketing Guide No. 1, *Strawberries*; and in Wall Charts, Marketing Posters No. 2 and 3, copies of which can be obtained free from the Ministry of Agriculture (Publications), St. Andrew's Place, London, N.W.1.

Efficiency in the packing-shed is fundamental to uniform grading and packing of strawberries.

The best way of picking is to travel along between the rows and pick from either side.

Strawberries

The correct way to pick is to pinch the stem between thumb and forefinger, and carefully place the fruit into the basket. Grading can be done in the field, and the punnets subsequently carried to the packing-shed in a multiple container (as shown). For transit to market the punnets are packed into trays or boxes.

Photo: *Ernest G. Neal*

The Feeding Habits of Badgers (Article on pp. 76-8)

A night photograph of adult badgers and a twelve-week-old cub. Badgers destroy a tremendous lot of vermin and insect pests, and on balance do more good than harm.

Photos: *Ernest G. Neal*

Badger's skull. The canine and molar teeth indicate a mixed animal and vegetable diet.

The mark of the badger.

The Recommended Grades are "Extra Selected R" and "Selected R". They differ only as regards size; quality is the same for both grades.

For "Extra Selected R", each berry must weigh at least ¼ oz. For "Selected R" grade, each berry must weigh at least ⅛ oz. and the average number of berries per lb. must not exceed 64. Condition, colour and blemish all have to be taken into consideration. The first essential of all fruit for marketing in the fresh state is that it should be firm enough to carry to market. Over-ripe strawberries become soft and often mouldy by the time they reach market, and the fruit should be picked so that it will have reached full maturity by the time of retail sale. The calyx should be attached to the berry and the length of stalk should not exceed ½ inch.

All berries should be clean, and free from blemish and damage. The colour requirements are that not less than two-thirds of the surface should be coloured red.

Unless 50 per cent of the fruit from a crop of strawberries reaches the standards laid down for "Extra Selected R" grade, it may be better not to grade out this better-sized fruit but rather let it improve the standard of the "Selected R" grade. However, the advantages of uniformity in a sample should always be borne in mind; a few large berries amongst an otherwise uniform pack of smaller berries will detract from the appearance and may result in poorer market returns.

Packing and Packing-sheds Strawberries are usually marketed in the chip or fibre board baskets and punnets packed in the field by the pickers. On arrival at the packing-shed the number of filled containers is credited to the picker and then handed over to the packer. They are weighed and berries added as necessary to give the correct net weight; the top berries may be "faced" for better appearance, but they should be representative of all the fruit in the lower layers. The grades should be kept separate—a simple matter if different containers are used for them. Top-grade fruit should not be packed in containers holding more than 1 lb., but "Selected" berries can be packed in 1-2 lb. units. For transit, these containers are packed into larger trays or boxes, according to the type of package.

To ensure that the output is of uniform grade and pack, careful supervision of the packing-shed is just as important as it is in picking. This final overseeing also acts as a check on the efficiency of the picking supervision. The operations in the packing-shed consist of receiving the filled containers from the pickers, crediting the number to each picker, checking for grade and quality, weighing and topping up the containers. On a smallholding this work is usually performed by the grower and his family, but for larger acreages the work will have to be delegated to well-trained, conscientious and reliable workers.

Except where, because of the continuing need to deal with other crops, a permanent packing-shed is available, the strawberry shed is usually of a temporary nature—often a tarpaulin on a wooden framework, or merely the shade of a tree. It should be sited as near as possible to the strawberry fields, preferably on the headland to reduce walking distances and so that the fruit can be taken under cover as soon as possible. It should be at the ends of the rows to reduce the temptation for the pickers to walk across the rows to reach the shed; suitability for road transport should also be taken into account. The shelter should provide sufficient space to accommodate a full day's picking, and should be large enough to store plenty of empty containers, as well as providing ample working space for the staff.

THE FEEDING HABITS OF BADGERS

ERNEST G. NEAL, M.Sc.
Taunton, Somerset

After many years of patient study of badgers, Mr. Neal is convinced that on balance they do much more good than harm, and that they are often unfairly blamed for the delinquency of other animals.

IT is usually possible to get a good general idea of the feeding habits of a mammal by looking at its teeth. If the skull of a badger is examined, the prominent canine teeth at once suggest a carnivorous diet, and the badger is, of course, classified in the order Carnivora. If, however, you look at the back molars, you find they are much more flattened than in typical carnivores; in fact, they resemble the teeth of vegetarians. These points taken together give a true picture of a badger's feeding habits, for it is a true omnivore, feeding on a great variety of animal and vegetable foods.

To discover the kinds of food eaten by a mammal, any one of three courses can be adopted. You can watch them while they are feeding, examine what they have already eaten by analysing the stomach contents or dung, or experiment to see which of various foods supplied to them are selected.

Direct observations are difficult, as badgers are fairly strictly nocturnal, although it is possible to watch them with the help of a strong beam from a red light, since they are practically blind to the red end of the spectrum. It is, however, very difficult to follow them to their feeding grounds undetected, so it is rather a matter of chance if you find out much in this way.

Stomach analysis is the most reliable method, but it is only easy when very little digestion has taken place. In practice, this means that the badger has to die towards the end of the night or in the early morning. This does not happen very often, as most badgers are either dug out and killed during the day, or knocked over by cars or lorries just after dark. Nevertheless, I have been able to analyse the stomachs of over thirty animals, and the results have been most useful.

Dung analysis reveals the indigestible remains, but the softer foods are missed altogether. Thus it gives a rather unbalanced view of the diet of the animal. It is, however, very useful for finding out the prevalence of certain kinds of food, such as rabbits or beetles, since the fur or wing-cases respectively are readily visible. With a microscope it is also easy enough to detect the bristles of earthworms, the softer parts of the body having been completed digested.

A Varied Diet By these and other means it has been possible over a period of many years to build up an accurate picture of the foods a badger will eat. On the animal side of the menu, rabbits, rats, mice and voles are all eaten in large numbers, though most of them are taken in the young state when still in the nest. Hedgehogs are often killed, and the skins neatly turned inside out are witness to the badger's skill in dissection. As many as four hedgehogs have been found in a single badger's stomach, though barely a spine was swallowed.

On wet nights, slugs, snails and especially earthworms form a high proportion of the badger's diet. On one occasion I counted 203 large earthworms in a badger's stomach, and a fortnight later another contained 163, with two moles to make up weight. Over half of the stomach analyses

which I have made revealed earthworms, often in large numbers. The larger beetles which are found in dung (like dor beetles) or under the turf (such as the fat grubs of the cockchafer) are commonly eaten. Overturned cow pads and shallow pits in grassland are often indications of a badger's search for these insects.

Badgers are also very fond of wasp grubs, and to get them they will quickly destroy a nest, regardless of the angry attacks of the wasps. It would appear that their skins are too tough for the stings to penetrate.

Badgers eat a great deal of vegetable material at various times of the year, but especially in late summer and winter. All kinds of fruits are taken, including windfall apples and pears, acorns, beech nuts and blackberries. They also dig up the underground storage organs of woodland plants. Grass is sometimes eaten in large amounts during the winter, and fungi are consumed occasionally. Corn is sometimes found in the droppings; it is usually oats, and as a rule it is taken when the corn is in stook.

The Badger and Poultry Poultry-killing by badgers has long been a vexed subject, and it is one which I have studied very carefully. Dealing with an animal as widespread as the badger, and one where population density varies so widely in different parts of the country, it is obvious that a dogmatic statement on this subject is useless. Speaking generally, the facts undoubtedly point to badgers doing little harm in this respect, but that they do occasionally kill poultry is equally certain. However, I am completely convinced that poultry do not figure largely in the diet of badgers in Britain, taking the species as a whole. In fact, the majority of badgers never touch them. On the other hand, in some parts of the country, and under special circumstances, poultry-killing is not unusual. It is this variation in habit that has led to so much argument as to whether badgers normally take poultry or not.

In many counties the problem hardly ever arises, and cases are so few that they can be ignored; in others, they occur every year to a limited extent. Unfortunately for the badger, because the odd one is caught in a hen-house, all badgers are at once suspect, and a hue and cry goes up for them to be destroyed. This attitude is both shortsighted and unjustifiable.

The badger's behaviour is largely governed by food supply, and where its natural foods are plentiful, poultry-killing is almost unknown. This state of affairs is upset if the badger population becomes too high and competition for food becomes acute. This is the main reason why there are more cases of badgers attacking poultry in the South-West, in Pembrokeshire, and in parts of Ireland, to name the more important regions. Another condition affecting the food supply is weather, and during severe spells of frost—especially in February and March—the sow badgers especially may take to poultry, as they are suckling cubs at this time and do not wish to leave them for long in search for food. Poultry-killing may also occur on the outskirts of towns where housing has recently spread on to country populated by badgers. The badgers remain, but their natural food supply diminishes.

Now the badger is very often blamed for the deeds of other animals, and it is essential that we should come to a true verdict before he is sentenced. Badgers are blamed every year for lamb-killing, though in fact this occurs so seldom that hardly any proved cases are known. The reason for blaming the badger is usually that lamb remains are found near the entrance to a badger set, and the obvious inference is drawn. This, however, is certain proof that the badger did *not* do it, as a badger does not bring back food

to its set. If the set is dug out it is practically certain that a fox will be discovered, since foxes very often use badger's sets as their earths. The same applies to poultry if their remains are found. A badger, if it kills, will eat the chicken on the spot or nearby; it will not bring it back.

The manner of the killing is also an indication of the true culprit. A fox usually goes for the neck of a hen and will eat the meat primarily. A badger normally bites the body and goes first for the entrails. If there are footprints about, the five-toed pad-marks of the badger, compared with the dog-like prints of the fox, are unmistakable.

More Good than Harm To assess the economic status of an animal, it is not enough to know what it eats. The important thing is to know its preferential foods, and how they vary throughout the year and from one part of the country to another. Being an omnivore, the details of the badger's diet obviously differ a great deal according to time, place and opportunity. However, certain facts stand out clearly. Its most important food is earthworms, with young rabbits an important second during the season. In fact, it may be said that earthworms are most important during the period October to April, and their place is taken by young rabbits, other small mammals, and beetles during spring and summer. Fruit and other vegetable matter is more important during late summer and winter, according to availability.

It is interesting to speculate on the indirect effect which myxomatosis may have on the badger. With rabbits largely gone, my own view is that the badger will easily adapt itself to rely on other foods. Being so omnivorous, this should not be difficult for the species as a whole, although in districts where rabbits have previously been plentiful and the badger population is high, it could lead to rather more attacks on poultry. That this will occur in the case of foxes I have little doubt, as they are much more dependent upon rabbits for their food and, being carnivorous, are far less adaptable.

It is well to remember that badgers, and to a less extent foxes, destroy a tremendous lot of vermin and insect pests, and I am convinced that badgers on balance do more good than harm. Thus if poultry are properly secured during the interim period of adaptation, it may well be that badgers will turn their attention to rats, mice, voles, beetles and other pests, and benefit man in the long run even more than when the rabbit was here in numbers. Hasty action against the badger would be a tragedy. The situation should be watched with care and understanding, as the position will certainly vary from one part of the country to another.

GOOD ESTATE MANAGEMENT

THE RABY ESTATE

N. E. Stroh, Q.A.L.A.S.
Agricultural Land Service, Northern Province

THE greater part of the Raby Estate almost certainly derives from the vast territory formerly held by the Nevils of Raby, one of whom married Maldred, a descendant of the Saxon family which owned Raby in the time of Canute, and thus succeeded to the original property in 1227. However, at the Rising of the North in 1569, the owner at that time, Charles, Sixth Earl of Westmorland, lost the Castle and the whole of his estates to the Crown. In 1626 the estate was bought by Sir Henry Vane the Elder, of Fairlawn in Kent, and it has remained the property of the Vane family until this day. Thus, except for the short interregnum when it was held by the Crown, the estate has been in the hands of two families only, Nevil and Vane, for nearly 900 years.

The Raby Estate is situated on the north bank of the River Tees and extends from approximately three miles west of Darlington to the top of Teesdale, where the boundaries of Durham, Cumberland and Westmorland meet. The estate itself is entirely in County Durham. The high-lying part, which stretches from Middleton-in-Teesdale to the top of the dale, was transferred by Lord Barnard to his eldest son, the Hon. H. J. N. Vane, in February 1947. Including this area, the estate covers approximately 55,000 acres and consists of three large tracts of land, each with its own particular characteristics and consequent problems of estate management. For the purposes of description, it can be detailed conveniently under the three headings of the Lower Raby Estate, Marwood and Langleydale, and Upper Teesdale.

Lower Raby Estate The lower part of the estate, which is situated roughly between Staindrop and Darlington (the market town for the district), comprises a number of first-class arable and mixed farms, averaging between 150 and 200 acres and with an average rental of 40*s*. per acre. In the extreme eastern portion there are several larger mixed farms, where a considerable amount of good quality barley is grown, the soil being eminently suitable for this crop. The heavy Down breeds of sheep are popular, with Oxfords, Suffolks, or their crosses, predominating.

Amongst the cattle, dairy herds, although present in fairly large numbers, are nevertheless in the minority, the stock policy in most cases being summer and winter fattening for the butcher. The native Shorthorn is the most popular breed. The estate has amongst the tenants some prominent breeders of livestock; the names of Snotterton, Wackerfield and Summerhouse Grange Farms are well known throughout the country.

The permanent fixed equipment consists mainly of stone-built buildings, with red pantile roofs. The buildings throughout the whole estate are whitewashed once every two years in accordance with the tenancy agreements, the estate supplying the lime and the tenants carrying out the work. Various legends account for this custom. According to one story, a former owner of the estate, the Duke of Cleveland, was stranded in a snowstorm in Upper Teesdale and had to take refuge in a farmhouse for the night. The farmer and his wife were lavish in their hospitality and, on leaving, the Duke, by way of repaying them for their kindness, asked if there was any-

thing required on their farm in the nature of repairs and improvements. Apparently the farmhouse roof was in poor condition, and the Duke promised that this would be renewed. When His Grace instructed his agent to attend to the roof of this farm, he was informed that it was not on his estate. Nevertheless, the roof was renewed, but from that time onwards all the buildings on the estate have been whitewashed to ensure that the owner knew his own farms!

Marwood and Langleydale That part of the estate which takes in Marwood and Langleydale extends westward from Staindrop nearly to Egglestone, and rises from 500 to 1,100 feet above sea level. The farms are almost entirely devoted to stock rearing, the aim being to breed Shorthorn cattle and Swaledale or Müle lambs for the local store market (although in recent years a larger proportion of the lambs have been graded at Darlington or Barnard Castle). The area consists chiefly of good quality permanent grass, and the average rent throughout is 20*s.* per acre. The land is ideally suited for rearing cattle and sheep, and several of the farms have rights on common land for breeding Swaledale sheep. Langleydale is made more picturesque by its whitewashed farmhouses and buildings, which stand out particularly well on a sunny day.

This part of Lord Barnard's estate is benefiting under the Livestock Rearing Act, and so far seventeen improvement schemes have been approved. In the main, these provide for additional accommodation for stock and modernization of farmhouses and cottages. The tenant farmers have greatly improved their farms by reseeding, and in many cases the plough has been right round the farm.

Despite the rearing activities, a considerable quantity of milk is also produced at Marwood and Langleydale. Most of the byres and dairies require certain alterations to comply with the Milk and Dairies Regulations, 1949, and the problem is being tackled by the estate staff as quickly as possible. This is, of course, very much a long-term operation.

Upper Teesdale Upper Teesdale, which now belongs to Lord Barnard's son, was developed and reclaimed from moorland by the owners during the late eighteenth and early nineteenth centuries, probably to provide land for the increasing population engaged in the lead-mining industry during the years of its prosperity. The area presents a serious management problem, for it rises from 800 feet above sea level at Middleton-in-Teesdale to 2,000 feet at Grasshill, near the county boundary. Indeed, Grasshill Farm is said to be the highest, or one of the highest, farms in England. With two exceptions, the farms in the higher reaches average only 50 acres of poorish meadow and pasture, with a right on the various commons for sheep. These rights, known as "stints", belong to each individual farm, and the commons regulations usually assess one stint at five sheep. Lead mining now exists only on a small scale, though a number of quarries are still working. Various minerals are extracted, but there is not the same amount of work available in these industries as there was.

Another problem has arisen from the fact that the smallholders have turned to milk production, which they find provides a higher and more regular income than stock rearing. In consequence, the estate has incurred heavy capital expenditure in relation to the size of the holding in order to allow the tenants to continue in milk production. Since only the larger holdings qualify under the Livestock Rearing Act, the estate is faced with the problem of low rents with which to meet the very high maintenance charge every year. However, twenty-three of the larger farms are now the subjects of improvement schemes under the Livestock Rearing Act.

Good Forestry The estate is managed from the Staindrop office by a resident agent, with a sub-agent at the office in Middleton-in-Teesdale. The office staff consists of an accountant and four clerks. As much work as possible is carried out on the estate by their own employees, comprising one clerk of works at Staindrop, and a building staff of 26. There is also a small sawmill and estate yard at Middleton-in-Teesdale, a maintenance staff to carry out the work at Upper Teesdale, and a well-equipped sawmill at Staindrop, employing six men. All the estate's requirements in the way of gates, fencing posts, etc., are made in the yard.

There are just over 2,000 acres of forests on the whole estate, and Lord Barnard takes such a great personal interest in his woods that the present agent has little to do with their management. The head forester has a staff of 24 under his command. The woodlands are managed very efficiently, and provide an excellent site for the practical courses for woodmen, which the Royal Forestry Society have had the privilege of using on several occasions. On the better land the main crop is hardwood, but higher up the crops are mostly coniferous, though hardwood is by no means neglected.

Teesdale presents special problems for forestry on account of its high elevation and severe climate, including high winds. As a result, except in specially favoured places, the establishment of economic woods is extremely difficult. Nevertheless, there are 277 acres of productive woodland.

Mixed Farming on the Home Farm The Home Farm comprises 1,034 acres which, during 1954, was divided as shown below. The high acreage of permanent grass is accounted for by the parkland around the Castle. A large herd of deer is kept there.

Cropping of the Home Farm, 1954

	acres		*acres*
Wheat	70	Rape	10
Oats	76	Kale	10
Mixed corn	30	Seeds for mowing	120
Potatoes	2	Seeds for grazing	166
Turnips and swedes	50	Meadow	30
Mangolds	4	Permanent grass	466

The stocking of the Home Farm consists of 106 cows and heifers, which form the rearing herd: no milk is sold off the holding. The cattle are Irish Black cows and heifers crossed with an Aberdeen-Angus bull, and there are 93 young cattle in the herd at present. Thirty sows and gilts for breeding are kept, and approximately 200 young pigs are reared. The sheep comprise 600 half-bred ewes, which are crossed with either a Suffolk or Oxford ram. The farm still retains six horses, and there are approximately 1,000 head of poultry. Labour consists of a farm manager and 13 workers.

In conclusion, it may be said that the Raby Estate furnishes an excellent example of the relationship between landlord and tenant. There are, indeed, many instances of co-operation in rehabilitating the permanent equipment on the holdings. The system of letting vacant farms to the sons or relations of existing tenants is normal practice. In sport as well as work, Lord Barnard, who has been Master or Joint Master of the Zetland Hunt for more than thirty years, is accompanied in the field by many of his tenants.

The writer acknowledges his indebtedness to Lord Barnard, the Hon. H. J. N. Vane, and Mr. K. A. Clark for their assistance in the preparation of this article.

CARROT-GROWING IN THE EAST RIDING OF YORKSHIRE

G. I. KEEN, N.D.H.

National Agricultural Advisory Service, Yorks and Lancs Province

Mechanization has now entered decisively into the thriving carrot-growing industry which has grown up on the sand lands of the East Riding during the last half-century.

VIRTUALLY unknown as a commercial outdoor crop in the East Riding in the earlier part of the century, carrots are now a regular feature of the farm rotation on the sand lands of the county. Every year some 3,000 acres, in areas ranging from 5 to 40 acres, are given over to them. Indeed, it is safe to say that where there is sand, there also are, or eventually will be, carrots. The sandy soils of the East Riding are fairly extensive. Spreading in all directions across the Plain of York between Weighton and Pocklington, and skirting the Wolds to the west, the sands extend to the south through Holme on Spalding Moor, and North and South Cave, in a 15-mile wide belt to Welton and Brough on the Humber. Outlying sands at Barmby Marsh end the westerly production area at the East Riding boundary, and there is a further small area at Sherburn in the Vale of Pickering. The crop has also developed steadily during the past few years in a potentially fertile area of Carr land in and around Leven.

In view of the nature of the soil, wind blowing is a serious problem, but hedges, strips of barley, strip spraying and similar methods are used by the carrot growers to counteract the tendency to drifting. Marling, at the rate of 150 tons or so per acre, is another way of combating the danger, and to this end modern excavating equipment is now in use in both old and newly-developed marl-pits. The use of tipping-trailer gear facilitates equal distribution of the marl at the lowest possible cost.

In the older carrot-growing areas, 5-7 year rotations are the general rule, the tendency being to keep carrots as far away from other carrots as is practicable, both as a means of pest and disease control and also to maintain a satisfactory rotation. The fact that this system is not fully efficient on a county basis appears to be due to an unfortunate lack of co-operation between neighbouring farmers, with the result that one occasionally sees the indiscriminate placing of carrot crops in nearby fields. Although practices vary, carrots often follow barley in the rotation, but occasionally they are preceded by sugar beet (the tops of which are eaten off by sheep after root clearance) or potatoes. With the latter crop, groundkeepers are a nuisance and require hand-weeding from the carrot rows, although winter ploughing of the potato land helps considerably by exposing the tubers to the weather and to the large flocks of foraging rooks which range the county. Short-term leys have been tried successfully as a preceding crop in the Vale of Pickering, and present trends indicate more interest in this practice, based on the assumption that, apart from the value of the vegetation, the root fibres will improve the soil structure.

Preparation and Initial Cultivation Liming is essential to good carrot production, particularly as some of the East Riding soils tend to be acid. The most severe cases occur where birch scrub has been cleared in the process of land reclamation. Subsoil acidity is corrected as far as possible by applying ground limestone before plough-

ing, followed by a later top dressing where necessary. Occasionally, subsoiling equipment is used to break what is known locally as a "Nossman pan". The name of this barrier to normal cultivation is apparently a colloquial reference to the tough, red-headed, invading Norseman of an earlier age, who required a whole army to defeat them at Stamford Bridge and is a graphic description of the problem in hand. Care is necessary in applying lime to Carr land, since excessive quantities may induce trace element deficiencies which can affect crop production adversely for several years.

Manure is seldom used on the carrot land, although some farms are known, usually on the very poor sands, where old farmyard manure, shoddy and fishmeal have been ploughed in during the autumn before spring sowing. Compound fertilizers are applied at rates varying between 6 and 10 cwt. per acre, based in the main on traditional practice. For example, where carrots follow barley, 10 cwt. of high-grade potash fertilizer is a normal application on a good farm, and this is justified by the tonnage returns over the past fifteen years. Additional phosphates or potash may be applied to correct acute deficiencies. Top dressings are given occasionally, the outstanding examples being on the Carr lands, where "Nitro-Chalk" is favoured as a stimulant, or a compound fertilizer is applied through adjusted fertilizer drills to "peak up" a crop during the second or third inter-row cultivator.

Barley stubbles are broken up soon after harvesting. Rolling is rare, except to consolidate early ploughed land for overwintering, otherwise sand drifting is prevalent in even the slightest breeze. Where the roller is used, it follows immediately behind the plough. Late ploughing is exceptionally practised where farmers prefer a good soil depth and a moist seedbed. In these circumstances, the work is done about seven days before sowing. The alternative is to allow at least one month between winter ploughing and the cultivations preceding sowing. In every case, a moist seedbed is essential, as this stimulates germination of the carrot seed in about ten days. Straight-tined harrows are used in the preparation of the seedbed.

To control the early weed population, pre-emergence cultivations are often done in the "safe period" between the fifth and seventh days after sowing, all subsequent cultivations being by inter-row equipment or gang labour using shim hoes. In a few years, however, gang labour for this work may have only historical importance.

Sowing In the early years the widely-known James Scarlet Intermediate was the main variety, but today the various strains of intermediate stump-rooted carrots and the variety Autumn King are favoured. The red-cored Chantenay types, which had a high reputation with canners and the public before the war, are not in such demand now, owing to variation in size and quality. James Scarlet Intermediate is still grown occasionally, and The Yorkshireman is a new introduction which has attracted some attention. On the whole, however, the main acreage nowadays is shared between the intermediate stump-rooted types and Autumn King. Yields vary between 9 and 22 tons per acre for the former, but may be as high as 32 tons per acre for Autumn King.

For early bunching, carrots of the stump-rooted type are sown in late January or February, depending upon the weather. In some cases, seed is chitted for this purpose, but this requires a careful technique and a foresight into the weather. Chitting is usually done in hessian bags holding loosely between 1 and 2 lb. of seed. Some growers use a larger bulk, but the general preference is for the 2 lb. bag. The seed is thoroughly soaked for a

short time in tepid water, after which the bags are laid out on benches in a warm shed or propagating house and turned daily, samples being checked from the third day onwards. Since the weather governs the sowing date, difficulty may be experienced in having chitted seed available in quantity at just the right time. Hence, a good deal of seed is wasted, but the loss is usually offset by the value of the ultimate crop. A seeding rate of 6 lb. per acre is used for these early sowings, which are usually at 12-inch row spacings.

The maincrop seed is sown from March onwards, the usual time being from mid-May to late June. Seed rates are related to row spacing and at 18-24 inches are fairly constant at 1¼-2½ lb. per acre, according to variety: with 12-inch spacing, the rate may be as high as 6-9 lb. per acre.

Ridge drilling was popular before the war. The seed was sown at a depth of 2 inches, and 1 inch of the ridge top was then scraped off by mechanical means about seven days after sowing, taking with it the initial weed growth. This method has now been superseded by drilling on the flat, using ganged seed drills attached to motorized tool-bar frames of several designs, one of which was invented and is manufactured in the county.

Pest and Weed Control The high labour costs involved in carrot-growing have undoubtedly influenced the growth of mechanization, and this increase in mechanical handling, together with the introduction of the newer methods of pest control, has made the crop more popular. Many growers are now following the recommendations resulting from the experimental work on Carrot fly carried out locally by the N.A.A.S. entomologists, by using 2 oz. of 50 per cent lindane (99 per cent *gamma*-BHC) to 1 lb. of seed, with a quantity of light fuel oil as a sticker. The results are very satisfactory. Less effective results have been obtained when the full recommendations have not been carried out, the main failure being due to using a less concentrated formulation of the high *gamma*-BHC, or to applying the powder to dry seed. Lindane, as a spray mixture with light fuel oils, has also been used to obtain further control of Carrot fly during the growing season, but this has mainly been where there was doubt about the effectiveness of the seed dressing. DDT is used less frequently and hedgerow spraying is carried out by a few growers only. Seed treatment and light fuel oil spraying are not used on the crop intended for early pulling, as any kind of check may delay marketing and mean losing the best prices.

So far, tainting or off-flavour have not been recorded in consequence of these treatments, but much interest is being taken in the use of aldrin and dieldrin which are at present under trial.

To control weeds in the main crop, there has been a rapid development in the use of light fuel oils, at rates varying between 20 and 80 gallons per acre. The highest recorded rate has been two applications of 60 gallons per acre on one field, with no residual taint. The usual method is to adapt the existing spraying equipment on a holding or farm to this method of weed control—that is, light tractors with tank and spray-bar attachment, or motorized tool-bar frames which can be efficiently calibrated to apply an estimated quantity per acre. Nozzle placement and other important technical factors are always under consideration.

Spraying is done before the weeds get woody, which is usually when the carrots are between 1 and 3 inches high, depending on the weather. In several instances spraying has been carried out earlier, with little harmful effect to the young plants. Late spraying is a disadvantage and may appreciably increase the cost of crop production, due to the fact that it is essential to pull by hand the vigorous weeds which develop in the rows.

Harvesting and Marketing Carrot-lifting methods vary from pulling, twisting, and bagging or clamping by hand, to partly- or fully-mechanized systems. Shovelling off the tops in advance of an improvised cultivator-tine lifter attached to a light tractor is a simple but rather lengthy process, although it is often used when the crop is to be clamped or when supplying a market with steady consignments. With ridged crops, the use of potato spinners serves a similar purpose, although there is some increase in root damage. These and other methods have led to the introduction of the cumbersome, yet effective, beet lifters. One type, in particular, has proved outstanding. This has improvised forward, horizontal, high-geared blade cutters, which trim the tops and clear the debris, thus facilitating lifting to the elevator which loads the truck moving alongside. Rotary hoe equipment is occasionally used in advance of a normal beet lifter.

Most hand work is paid for at piece rates—a good man being able to pull and clamp 1 sq. chain a day (equivalent to 2 tons in a 20-ton crop). The present rate is around 35*s.* per sq. chain, as against 4*s.* in 1914. Where the crop is lifted mechanically, the labour is normally paid by the day, but the produce from machine harvesting is invariably washed and bagged for immediate dispatch to market. Costings of a fully mechanized unit, with merely incidental hand labour, shows a saving of from £10 to £15 or more per acre on a crop which, from sowing to final harvesting, would normally cost about £75 per acre to produce by hand labour. Incidentally, machines are now being introduced in the washing process. Various types of potato washing machines are in use in the area, as are also a few prototypes, which have been invented with the carrot crop in mind to reduce damage by bruising.

Many growers consider that full mechanization is essential to keep production costs down to a satisfactory minimum. The loss through damage in the field, washing and grading is compensated by the quick transit of the crop from field to market.

The present tendency among the East Riding growers is to lift and move no more of the crop than is required. Hence clamping is done only in areas where tradition dies hard or where an assured demand exists. This latter situation leads to methods of preserving the crop by ridging over the crowns—the object being the dual one of preventing frost damage and facilitating drainage. Efficient drainage is most important, because Violet Root Rot develops rapidly under flood conditions.

Although the present season was so disastrous, the general improvement in quality which has resulted from the more positive approach to Carrot fly control has encouraged many growers to become interested in washing the crop. A number of growers, however, consider that the variety Autumn King quickly deteriorates when topped by machinery and washed, since at this stage the roots are extremely brittle. With the intermediate stump-rooted varieties, the tops die down early, so the crop is more mature and can be handled with less concern.

The demand for East Riding carrots comes from all quarters of the British Isles, but it is interesting to note that Scottish buyers prefer a bold, unwashed sample, whereas the English markets have a divided preference for unwashed and washed, relating this to the promptness or otherwise of the retailers' demand. On the matter of size, all buyers tend to reject a too large sample. On the whole, they prefer a medium to bold sample. This, however, reflects back to seed rates and plant populations per acre, and directly affects the basic economics of carrot production.

FORTHCOMING AGRICULTURAL SHOWS

Date	Show	Location
May		
10-12	**Devon County**	Whipton, near Exeter
10-11	**Oxfordshire**	Oxford Airport
12	**Royal Windsor Horse**	Home Park, Windsor
18-19	**Shropshire and West Midland**	Shrewsbury
25	**Hertfordshire**	Willian, near Letchworth
25-28	**Royal Ulster**	Balmoral, Belfast
25-26	**Warwickshire**	Stratford-on-Avon
28	**Cambridgeshire and Isle of Ely**	Trumpington, Cambridge
30	**Fareham and Hants**	Cams Alders, Fareham
30	**North Somerset**	Ashton Court, near Bristol
30	**Surrey**	Eashing Park, Godalming
June		
1-4	**BATH AND WEST AND SOUTHERN COUNTIES**	Launceston
1-2	**Suffolk**	Wrentham, near Beccles
8-9	**Cheshire**	Chester
8-9	**Essex**	Halstead
9-11	**Richmond Royal Horse**	Richmond, Surrey
14-16	**THREE COUNTIES**	Worcester
15-16	**Lincolnshire**	Lincoln
17-18	**Leicestershire**	Enderby, near Leicester
18	**Huntingdonshire**	St. Neots
21-24	**ROYAL HIGHLAND**	Edinburgh
22-25	**ROYAL COUNTIES**	Horsham
29-30	**Norfolk (Royal)**	Norwich
July		
5-8	**ROYAL SHOW**	Nottingham

These dates are subject to revision or even cancellation.

THE NATIONAL CROP PROTECTION CONFERENCE

The National Crop Protection Conference, which is concerned with the practical aspects of the use of insecticides and fungicides in agriculture and horticulture, will be held this year at Eastbourne on November 1-3. Further details will be announced later by the organizers.

AGRICULTURAL STATISTICS
ENGLAND AND WALES

June 1954, Agricultural Returns (Final)

CROPS AND GRASS

(*thousand acres*)

DESCRIPTION	1939	1953	1954
Wheat	1,683	2,143	2,377
Barley	910	2,025	1,874
Oats	1,358	1,664	1,469
Mixed corn	83	794	593
Rye, for threshing	(b)	65	41
Total corn	**4,034**	**6,690**	**6,355**
Beans, for stockfeeding	133	140	119
Peas, for stockfeeding	37	39	31
Potatoes, first earlies	56	120	120
Potatoes, main crop and second earlies	398	552	529
Total potatoes	**454**	**672**	**649**
Turnips and swedes for stockfeeding	396(c)	304	288
Sugar beet (for sugar)	337	404	423
Fodder beet (all types of high dry matter content)	(b)	64	40
Mangolds	210	207	198
Rape	53	142	144
Cabbage, kale, savoys and kohl rabi, for stockfeeding	94	284	297
Vetches or tares	49	33	24
Mustard, for seed, fodder or ploughing in	48	38	34
Linseed	4	10	3
Flax, for fibre		16	17
Hops	19	22	20
Orchards with crops, fallow, or grass below the trees	236	261	257
Orchards with small fruit below the trees	18	12	10
Small fruit, not under orchard trees	29	31	31
Vegetables for human consumption (excluding potatoes), hardy nursery stock, flowers and crops under glass	275	452	452
Fruit and vegetables, not grown primarily for sale	(b)	14	12
All other crops	48	25	23
Bare fallow	355	217	272
Total of crops and fallow (tillage)	**6,830**	**10,075**	**9,699**
Lucerne	32	109	111
Temporary grass (including clover and sainfoin): for mowing	1,304	2,209	2,253
for grazing	768	1,447	1,623
Total temporary grass	**2,072**	**3,655**	**3,875**
TOTAL ARABLE LAND	**8,935**	13,840	13,685
Permanent grass for mowing	4,612	2,892	2,786
Permanent grass for grazing	11,097	7,662	7,993
Total permanent grass	**15,709**	**10,554**	**10,779**
Arable and permanent grass temporarily out of use through flooding	—	118	51(e)
TOTAL ACREAGE OF CROPS AND GRASS (a)	**24,643**	**24,511**	**24,515**
Rough grazings: Sole right (excluding acreage temporarily out of use through flooding)	4,179	3,806	3,755
" " (temporarily out of use through flooding)	—	18	9(e)
Total sole right	**4,179**	**3,824**	**3,763**
Common rough grazings	1,361	1,479	1,479(d)
Total rough grazings	**5,541**	**5,303**	**5,242**

(a) Excludes rough grazings.
(b) Not separately returned.
(c) Includes turnips and swedes for human consumption.
(d) Provisional.
(e) In 1954 figures of flooded areas were collected only in respect of the areas affected by the East Coast flooding of January–February 1953.

SMALL FRUIT

(thousand acres)

DESCRIPTION	1939	1953	1954
Strawberries	18.7	16.5	17.6
Raspberries	4.1	3.8	3.5
Currants, black	10.4	13.0	11.4
Currants, red and white	2.3	1.2	1.0
Gooseberries	9.1	6.7	6.2
Loganberries and cultivated blackberries	2.5	1.2	1.2
Total	**47.2**	**42.4**	**40.8**

VEGETABLES FOR HUMAN CONSUMPTION, HARDY NURSERY STOCK, FLOWERS AND CROPS UNDER GLASS

(thousand acres)

DESCRIPTION	1939	1953	1954
Vegetables for human consumption (excluding potatoes) grown in the open:			
Brussels sprouts	38.0	49.4	43.8
Remaining spring cabbage (planted in previous year)	44.1	8.5	5.8
Summer cabbage		9.4	8.1
Autumn cabbage		5.2	5.0
Winter cabbage		13.7	12.6
Autumn savoys		3.3	2.9
Winter savoys		9.2	9.1
Kale and sprouting broccoli		1.8	1.9
Winter cauliflower or broccoli (heading):			
Remaining from previous year's plantings	18.9	2.2	2.3
Planted in the current year		8.7	9.2
Summer and autumn cauliflower:			
Early summer sown under glass and planted in the open		3.9	4.3
Late summer and autumn (open sown)		8.3	7.8
Carrots, earlies (grown for bunching only)	16.1	2.4	2.4
Carrots, main crop		28.8	24.0
Parsnips	(a)	3.7	3.3
Turnips and swedes	(a)	4.2	4.2
Beetroot	(a)	8.2	6.9
Onions, grown for salad	1.7	1.4	1.1
Onions, for harvesting dry		5.1	4.0
Beans, broad	17.8	5.1	4.6
Beans, runner		7.5	7.6
Beans, dwarf or french		1.6	2.0
Peas, green for market	60.6	46.5	42.7
Peas, green for canning or quick freezing	28.0	32.3	40.5
Peas, for harvesting dry		118.6	131.9
Asparagus	2.6	1.5	1.5
Celery	6.7	4.5	4.6
Lettuce	5.9	7.3	7.1
Rhubarb	7.2	6.1	5.6
Tomatoes (growing in the open)	0.2	1.5	1.4
Other vegetables and mixed areas	(a)	14.0	14.1
Total	**247.7**	**424.3**	**421.9**
Hardy nursery stock:			
Fruit trees, fruit bushes and other fruit stock	10.5	10.4	4.0
Ornamental trees and shrubs			4.2
Other nursery stock, (herbaceous plants, alpines, etc.)			4.0
Bulbs and flowers in the open:			
Bulbs grown for flowers:			
Daffodils (Narcissi)	7.7	2.0	2.9
Tulips		1.2	1.4
Other bulb flowers		0.8	0.7
Bulbs grown for sale as bulbs:			
Daffodils (Narcissi)		0.8	1.0
Tulips		0.9	1.0
Other bulbs		0.2	0.2
Other flowers, not under glass	5.8	7.1	6.6
Total	**13.5**	**13.0**	**13.8**
All crops grown under glass	**3.3**	**3.9**	**4.4**

(a) Not returned.

The figures for 1953 and 1954 are based on returns which account for almost 100 per cent of the tota area returned under this heading.

LIVESTOCK

(thousands)

DESCRIPTION		1939	1953	1954
Cows and heifers in milk:				
For producing milk or calves for the dairy herd		2,255	2,140	2,170
Mainly for producing calves for beef			303	327
Cows in calf but not in milk:				
Intended for producing milk or calves for the dairy herd		392	378	361
Intended mainly for producing calves for beef ...			85	75
Heifers in calf with first calf		459	645	660
Bulls for service		91	77	73
Bulls (inc. bull calves) being reared for service ...		43	31	28
Other cattle:				
2 years old and over	Male (Steers) ...	(a)	548	548
	Female	(a)	653	625
	Total	**944**	**1,200**	**1,173**
1 year old and under 2	Male (Steers) ...	(a)	445	505
	Female	(a)	966	1,017
	Total	**1,346**	**1,411**	**1,521**
Under 1 year old	Male (Steers) ...	(a)	506	574
(excluding bull calves	Female	(a)	1,086	1,105
being reared for service)	**Total**	**1,242**	**1,592**	**1,680**
TOTAL CATTLE AND CALVES		**6,770**	**7,861**	**8,067**
Sheep one year old and over:				
Ewes for breeding		7,160	5,261	5,441
Two-tooth (shearling) ewes		1,477	1,287	1,314
Rams for service		205	145	151
Other sheep one year old and over		1,021	1,366	1,374
Total one year old and over		**9,863**	**8,060**	**8,279**
Sheep under one year old:				
Ram lambs for service		156	64	56
Other sheep and lambs		7,967	5,971	6,178
Total under one year old		**8,123**	**6,034**	**6,234**
TOTAL SHEEP AND LAMBS		**17,986**	**14,094**	**14,513**
Sows in pig		(a)	262	333
Gilts in pig		(a)	134	137
Other sows for breeding		(a)	156	190
Total sows for breeding		**449**	**553**	**659**
Barren sows for fattening		(b)	15	(b)
Boars for service		30	30	38
Young boars being reared for service		(b)	11(11.3)	(b)
All other pigs (not entered above):				
5 months and over		633	820	909
2-5 months old		1,516	1,524	2,049
Under 2 months old		888	983	1,223
Total all other pigs		**3,036**	**3,327**	**4,181**
TOTAL PIGS		**3,515**	**3,936**	**4,878**
Fowls:				
6 months old and over		23,154	27,950	27,816
Under 6 months old		29,758	36,214	32,577
Total fowls		**52,912**	**64,164**	**60,393**
Ducks		2,237	1,768	1,278
Geese		584	637	564
Turkeys		693	1,057	1,104
TOTAL POULTRY		**56,426(c)**	**67,626**	**63,339**

(a) Not collected separately.
(b) Not collected separately—included under "All other pigs".
(c) As a result of war-time controls, many small sized holdings were recorded for the first time in 1941. It is estimated that to make the totals prior to 1941 reasonably comparable with later years some 3 or 4 million birds should be added in England and Wales.

LIVESTOCK contd.

(thousands)

DESCRIPTION	1939	1953	1954
Horses used for agricultural purposes or by Market Gardeners:			
Mares (including those kept for breeding) ...	347	109	92
Geldings	202	72	60
Unbroken horses of 1 year old and over:			
Light	110	13	(a)
Heavy		6	6
Horses under 1 year old:			
Light	15	5	(a)
Heavy	35	3	3
Stallions being used for service:			
Light	5(4.6)	1(0.8)	(a)
Heavy		–(0.4)	–(0.4)
All other horses and ponies (not entered above) ...	132	74	93
TOTAL HORSES	**846**	**282**	**255**

LABOUR

(thousands)

DESCRIPTION	1939	1953(b)	1954(b)
Regular workers:			
Male, 65 years old and over	375.3	23.4	21.9
„ 21 years old and under 65		376.5	365.6
„ 18 years old and under 21	44.7	32.8	32.6
„ under 18 years old	50.8	42.0	42.8
Total	**470.8**	**474.7**	**462.9**
Women and girls	40.3	45.6	42.5
Total male and female	**511.1**	**520.3**	**505.4**
Casual workers:			
Male, 21 years old and over	57.4	93.8	87.2
„ under 21 years old	5.9	10.4	10.1
Total	**63.3**	**104.2**	**97.3**
Women and girls	32.7	58.6	55.0
Total male and female	**96.0**	**162.8**	**152.3**
Total male workers	**534.1**	**579.0**	**560.2**
Total female workers	**73.0**	**104.2**	**97.5**
TOTAL WORKERS	**607.1**	**683.1**	**657.7**

(a) Not collected separately—included under "All other horses and ponies".
(b) Revised and more comprehensive instructions on the Labour Section of the form, introduced for the first time in September 1948, resulted in the return of additional workers. The figures for June 1953 and June 1954 are not, therefore, comparable with those for 1939.

FARMING AFFAIRS

Pig Recording Pays Among a sample of 55 ordinary commercial firms in East Anglia, the average number of weaners produced per litter varied from 5 to 10. The amount of meal required to fatten a weaner for bacon varied from 5 cwt. to over 9 cwt., and the return per bacon pig during the past year varied from a profit of over £7 to a loss of nearly £3!

These are very wide differences in the level of performance and suggest that on many farms there is room for improving efficiency in pig production and thereby increasing profits.

Consider first the breeding of pigs. Here the objective is to produce weaners. The more weaners per sow, the cheaper each becomes. This is because the extra cost of rearing an additional weaner is very small. In terms of food, it may amount to about 60 lb. of meal for the sow and some creep feed for the piglet—perhaps ¾ cwt. in all at a total cost of 25–30*s*. Yet this extra piglet may well be worth £5 at weaning and thus add £3 10*s*. to Breeding Stock profit.

Sow records of piglets born and piglets reared together with their weight are invaluable for spotlighting any weaknesses and for helping the selection of breeding stock or tightening up on management. It is just this information which the official scheme of National Pig Records* sets out to provide for farmers.

It is interesting to note in this connection that a sow's annual keep, including creep feed and a share of the boar's ration, will approximate to 30 cwt. at a cost of, say, £50. If weaners are worth £5 each, then 10 must be produced per sow each year merely to cover food cost. It is only the weaners above this number which can bring any profit at all. If 11 weaners leave a profit, then 12 would double it! Of course, weaner numbers need to be higher than this to earn a true profit, since here only food cost has been considered. But the principle remains that small increases in weaner numbers mean large increases in profits.

When it comes to assessing the quality (as distinct from only the number and weight) of weaners produced, fattening efficiency, together with any carcass grading, must surely be the final test for the commercial farmer. The carcass grading of ear-marked bacon pigs is readily available from the bacon factory, and fattening efficiency may be assessed by dividing the weight of food which a pig consumes between weaning and slaughter by the live weight which it gains in this period. Clearly it will be necessary to keep accurate records if this average food requirement per pound liveweight gain (or more briefly, the meat : meal ratio) is to be calculated. Once, however, a farmer has this information for the progeny of various sows mated to particular stock boars, he has some very useful data on which to base a policy improvement. This information incidentally may also be recorded under the National Pig Records Scheme by participation in the Nominated Boar section.

Remember that for a 30 lb. weaner to become a baconer of 8 score dead weight, it must gain something like 180 lb. of live weight. Small improvements in the meat : meal ratio are thus multiplied by 180. This means that a reduction of one-tenth lb. in this ratio will save 18 lb. of fattening food per pig which, at £28 per ton, would be worth 4*s*. 6*d*. for every pig produced. Since this meat : meal ratio has been found to vary on different farms from just over 3 lb. to nearly 6 lb. of meal per lb. liveweight gain, there must be very few farms where no improvement is possible.

Reliable records are thus a necessity for the planned improvement of pigs,

* To become a member of the Scheme apply to the Pig Recording Officer at the County Agricultural Executive Committee.

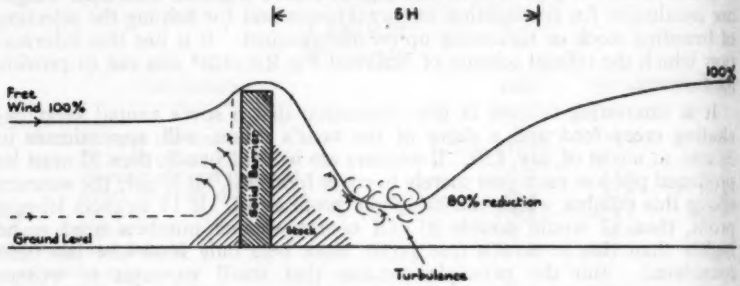
and since even small improvements have a considerable effect on profit, there can be little doubt that pig recording will pay.

G. B. Clarke

Farm and Forest: 2. Planting of Shelter-belts

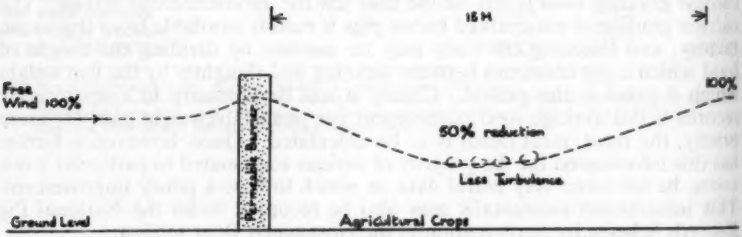
Last month it was suggested that the farmer might well examine what forestry has to offer. Quite obviously, the formation of shelter-belts, which not only protect crops and stock but give the farmer a valuable raw material for use on the farm, must have high priority.

Before looking into the advantages (and the disadvantages) which follow the planting of shelter-belts, or their correct siting, it is necessary to appreciate the physical effects of such a barrier on wind, local climate, and so forth. Very briefly, a dense, impermeable belt gives a greater reduction in wind force than a permeable one, but this reduction is effective for a shorter distance and there tends to be more turbulence at the point of recovery (see the diagrams below). It is clear that a dense barrier is preferable for sheltering stock, but for agricultural crops, particularly corn or hay which are liable to be laid by turbulence, the permeable belt is better.



H = Height of Belt
Reduction of Wind extends to 5 x H

Fig. 1. Solid barrier



H = Height of Belt
Reduction of Wind extends to 15 x H

Fig. 2. Permeable barrier

Leaving aside orchards, market gardens and hops (a specialized subject), the main agricultural requirements for shelter are: (a) for arable crops and enclosed fields; (b) for buildings; and (c) for stock. In the case of crops, shelter is required mainly during the spring and summer growing seasons. By its use, earlier growth is obtained, the risk of physical damage is reduced, and heavier yields can be expected. The need here is for wind reduction to be spread over as wide an area as possible. With buildings, the main considerations are reduction of storm damage to roofs and a general im-

provement in living conditions and amenities. The requirement for stock is the maximum amount of shelter, including shelter from abnormal winds at a given point or series of points. The benefits which result are that: (a) more valuable breeds can be kept under severe conditions; (b) stock can be out-wintered on farms where this would normally be impossible; and (c) cattle can be kept where, without shelter, only sheep could be grazed. (In this connection it should be borne in mind that cattle-grazing on rough land leads to improved keep.) Among the advantages to the sheep farmer are that lambing losses in hill areas are less when there is adequate shelter, while, on sheep runs generally, shelter may be valuable if cold weather follows shearing. On all types of farm posts, stakes, rails, hurdles, gates, barn posts, etc., arise as valuable products.

Certain disadvantages must not be overlooked. A shelter-belt takes up space which sometimes can be ill-spared, and there is competition between the trees and agricultural crops for light, plant foods and moisture. Under some conditions, night temperatures may be lower in the protected zone, and the land is slower to dry out after wet weather. Shelter-belts harbour vermin (though this can be an advantage to those employed on vermin destruction), while the accumulation of leaf litter from hardwoods tends to make the grazing less palatable to animals. Snow drifts in the lee of shelter-belts, but this fact can be turned to advantage, since the shepherd knows just where to look for buried sheep, instead of having to search all over the mountain.

The question of choosing the precise site for a windbreak is one which is very much more easy to deal with on the ground than on paper, since conditions vary so much from locality to locality. However, some broad principles are involved.

In the case of shelter for arable fields, it is usually a question of striking a balance between the degree of shelter to be obtained and the amount of land which can be spared. Much can be achieved by planting up all waste ground such as dingles, unploughable banks, and even lowland watercourses. Otherwise, the belt will usually follow the field boundary. For buildings, the exact position is really a matter of common sense. It is most important not to plant too close to buildings, where mature trees will overhang and may be a possible source of danger when windblown. When planting around a farmhouse, it is as well to remember that a well-sheltered home paddock for young stock and sick beasts is a great advantage. For shelter on the open hill, it must be accepted that trees do not like exposure. The aim should be to make the plantation complementary to existing local features. Where exposure is severe, it is a mistake to plant in the teeth of the wind on a bare ridge or exposed spur.

W. A. Cadman

The Mechanic on the Farm: 13. Stripped Screw Threads Much of the metal work done in the farm is concerned with nuts and bolts and threaded studs, and trouble frequently arises when the thread on a nut or bolt is stripped. A stock of new nuts, bolts and studs might make replacement possible without the need for taps and dies to form new threads, but the stock carried would have to be very large, and also there are some circumstances in which simple replacement cannot put the matter right. A stud may have broken off within a casting, and in drilling it out the hole may have been enlarged. In other instances the thread in the hole may be stripped. If the threaded hole is part of the main structure of the component, the hole will probably have to be retapped to take an oversize stud. If much machinery is being handled, it is therefore worth while to build up sets of taps and dies in various sizes. Taps are for

cutting the internal thread in a hole or a nut, while dies cut the external threads to make a stud or bolt.

Taps are, in fact, very hard screws with three or four flutes cut along their length. The ends of the thread on the ridge between these flutes become a cutting edge. The full set for each size of thread consists of three taps. The first to be used on the drilled hole is a taper tap. If the opening to be threaded is a through hole, the cutting can be completed by screwing this taper tap right through; but if the hole is blind, another tap, a parallel-sided one, may have to follow. The third implement in the set, called the plug tap, cleans out the threads and gives them their final shape. Taps have square shanks and fit into a wrench.

Small dies are shaped like nuts, with three or four small holes to make cutting edges on the threads and to give clearance for the cuttings. In some sizes the die nut is made with a split and is sprung open slightly so that a little adjustment in the diameter of the cutting face can be made by pinching the die in its holder or stock. Larger dies are made in halves. The halves slide in the holder and can be brought closer together to reduce the diameter of cut slightly.

In working taps and dies, it is well to ease the cutting edges backwards and forwards, edging onwards a little at a time, rather than attempt to drive straight through. In addition, taps are brittle, and care must therefore be taken to keep the tap wrench perpendicular to the hole in which it is working. Bending will break the tap.

Taps and dies can be used equally as well for re-forming threads that have become damaged as for making new parts. Burred threads on bolts and studs can, however, often be reshaped by a special kind of file, called a thread restorer, which has teeth made to fit between the threads. A thread restorer of this kind can also be used, in conjunction with an ordinary file, to prepare a good starting thread on a bolt which has been sawn. But a quicker way of making sure that the jagged edge at the saw cut will not prevent the nut being started is to put a nut on the bolt and screw it down out of the way before the saw cut is made. When this nut is taken off, it will reshape the jagged edge and permit easy replacement of the original nut.

H. J. Hine

Colorado Beetle in 1954 The number of Colorado beetles found in England and Wales in 1954 was the lowest recorded since 1946: only thirty-five single beetles were found in any part of the country. The following table summarizes the year's finds: figures for the two previous years are given for comparison.

	1954	1953	1952
Beetles associated with or on imported produce ...	20	38	64
Beetles found on ships	9	12	19
Docksides and beaches	0	8	1
Inland on potatoes	0	0	0
Inland miscellaneous	2	8	27
Odd dead beetles	3	3	0
On aircraft	1	0	1
	35	69	112
No. of breeding colonies	0	0	2

Lettuce imports were again restricted after February 28, and only three beetles were found before this date—one on Spanish and two on French lettuce. The small number found on shipping during the spring and summer is a reflection of the slight activity of the beetle on the Continent. During a similar period in 1948, 279 beetles were found on ships.

Of the twenty beetles found on imported produce, nine were reported during July 22-23 on wood pulp imported from Portugal. Seven were found on the ship before the cargo was discharged into barges for transport up the River Medway, and the remainder were discovered on the mill wharf at Larkfield, Kent.

Only one beetle was found in Scotland—on July 5, in a crate of apricots shipped from Spain.

The area in which protective spraying was carried out in 1954 was approximately the same as in 1953; 14,740 acres of potatoes were sprayed with DDT 25 per cent miscible liquid, and 300 acres in Essex were treated with 5 per cent DDT dust. The spraying started on June 10 and ended on July 28, and, as in the previous year, the work was delayed by heavy rain. The potato foliage made rapid growth during the wet weather and 350 acres in the proposed spraying area had to be left unsprayed because of the danger of damage to the haulm. Potatoes in the Romney Marsh were again sprayed by helicopter. High winds and rain caused delay, but 1,917 acres were treated with DDT emulsion.

The fields in the area to be treated are surveyed every year. In 1955 it is proposed to carry out protective spraying only in Kent and Essex, but maps will also be prepared of potato fields in Surrey, so that if breeding colonies should be found there spraying teams can operate immediately.

The Ministry greatly appreciates the continued vigilance of local authorities, police and members of the public, and is grateful for their ready assistance in reporting suspected Colorado beetles. It also thanks the staff of Plant Protection Ltd. for organizing the spraying compaign, and Pest Control Ltd. for the helicopter work.

I. R. Harrison

The Norfolk Agricultural Station Now that the work of the Ministry's Experimental Husbandry Farms is becoming more generally known throughout the farming world, the publication of the Annual Report of the Norfolk Agricultural Station for 1953-54 serves as a reminder that this was one of the enterprises which pioneered the importance of the field experiment as a link between pure research and improved farm practice. One of the chief aims of the Station has always been to find solutions to the Norfolk farmer's problems and to test new ideas for his benefit—and this despite the fact that after the First World War co-operation with outside bodies—the N.I.A.B., the Sugar Beet Research and Education Committee, and the R.A.S.E.—widened the scope of the Station's work.

Perhaps the activity of the Sprowston farm best known outside Norfolk, and with which the name of the Director, Mr. Frank Rayns, has been associated for more than thirty years, is the series of investigations on sugar beet. These date from the introduction of the crop into British farming, and the present report includes a summary of one of the most notable of these experiments—the maintenance of fertility on light land where sugar beet replaced the traditional folded roots. After four 5-course rotations on the same experimental area, not only did beet tops ploughed in or fed to sheep produce the same effect on the following crops as the equivalent feeding value of swedes folded by sheep, but where the tops were carted off and fed elsewhere, yields could be maintained by one additional dressing of fertilizer during the rotation. At the close of the experiment the yields of successive barley crops grown without further treatment surprisingly gave no indication that either sheep or tops ploughed in had built up any fertility that was not exhausted within four years.

An investigation is also reported in which advantage was taken of a field badly infected with Eyespot disease to demonstrate how far this soil-borne fungus disease of cereals could be kept under control by suitable rotations. The plots were under different rotations for four years, and an examination of the final crop, which was wheat in all cases, showed that the disease was by no means eliminated even after a two-year rest from cereals, but that the percentage infection for this rotation was much less than where only one year's break was allowed. Where susceptible crops were grown each year, the proportion of infested straws was no less than 80 per cent.

A new development of great interest at Sprowston has been the setting up of a Turkey Demonstration Centre by the Ministry of Agriculture. The primary purpose of the centre is to demonstrate how selective breeding on family lines can improve food conversion and carcass quality in a turkey flock. The enterprise is being financed for three years by American Conditional Aid funds.

The report is available only to members of the Station, who number nearly 900. This year the annual subscription was raised from a nominal 5*s.* to £1, but for this modest sum the member receives not only the Annual Report and Farm Guide, but additional interim progress reports which bridge the intervals between the two chief publications of the year, and not least, the opportunity to visit the farm on the Member's Open Days during the summer.

P. N. Harvey

Commonwealth Farmers establish new Records The overall picture of agricultural production in Commonwealth countries since the war has been one of continual progress. Production in most countries has risen far more quickly than that of the rest of the world, and several new records, notably in rubber, wool and groundnuts, have been established. Compared with the immediate pre-war average, output in the United Kingdom and Canada rose by more than half, while in Southern Rhodesia it increased nearly threefold. In India, where for some years production has been below pre-war levels, there has also been a substantial increase.

In exports, too, despite increasing population and consumption in producing countries, new heights were reached for both raw materials and foodstuffs. In 1951 and 1952 wheat and tobacco from Canada, dairy produce from New Zealand, coffee from Uganda, and tobacco from India reached levels never before attained. And in 1953 the story was continued, with cotton, tea, fruit, sugar, sisal and vegetable oils setting up new records for particular members of the Commonwealth.

The United Kingdom is still the world's largest importer of agricultural products, particularly of foodstuffs, and the most important market for Commonwealth countries. It is, however, especially interesting to note the substantial growth in the production of agricultural machinery in the United Kingdom. The value of Commonwealth exports of machinery (almost entirely from the U.K. and Canada) rose from £3 million before the war to nearly £90 million in 1953.

These few examples of the way in which the Commonwealth is outstripping the rest in the pace of its expanding production and exports serve to illustrate the tremendous virility of agricultural enterprise in these areas. The full story, told in a recent report* of the Commonwealth Executive Committee, is a most encouraging one for those who from time to time may have experienced doubts as to the ability of the world to feed its growing millions.

* *Commonwealth Agriculture*. Obtainable from any Sale Office of H.M. Stationery Office, or through any bookseller, price 2*s.* 6*d.* (2*s.* 8*d.* by post).

IN BRIEF

We have pleasure in introducing this new feature in which we hope every month to present briefly items of agricultural interest collected from home and overseas.

Bad Hay is Poor Feed

As the schoolgirl wrote in her essay, "There are many ways of making hay, and some are worse than others". This implies more than we think the young lady intended; nevertheless, it is true that some shockingly bad hay continues to be made every year. And bad hay means poor feed. On many farms, given so-called "traditional haymaking weather," the grass is left to bake thoroughly on one side before it is turned, so losing much of its food value—*and* it takes longer to dry in a tight compact swath.

The quality of hay from leys is often disappointing, largely because of low clover content and late cutting. Keep an eye on the protein content. Manuring, type of herbage, stage of cutting, method of making—and, of course, the weather!—all have an influence on quality. It has been estimated that if the protein content of hay could be increased by only 1 per cent on 100 tons, this would be equal to the protein obtained from about 5 tons of dairy cake.

Electricity on the Farm

A slight improvement in the number of forms in England and Wales connected with electric light and power supply was revealed by the Minister of Agriculture in the House recently. Of equipped holdings—that is, those farms classed by the different area boards as capable of being connected to a mains supply—38 per cent in England and 69 per cent in Wales were without electric light or power at the end of 1954. The corresponding figures at the end of 1953 were 43 per cent in England and 74 per cent in Wales.

Apple Sawfly Control

BHC spray applied at petal fall (about the third week in May) will control sawfly. 1 lb. of 50 per cent wettable powder per 100 gallon of water is recommended, and to this can be added the petal fall scab spray—1 gallon of lime sulphur. Nicotine is not as effective as BHC, but it is still used by some growers; 8 fluid ounces of 95-98 per cent nicotine with a wetting agent are used in 100 gallon water.

But be careful of the bees. Remove hives from the orchard before spraying, and cut the flowers of dandelions and other weeds beneath the trees. Spray drift on to hedgerow flowers should also be avoided as far as possible.

Chick Sexing Instrument

The Japanese have taken a further step with chick sexing. They have invented an electrically-operated instrument with an illuminated microscopic eye-piece with a small glass tube attached to it. The tube is inserted into the cloaca of the chick and, when its end is placed against the genital organs, the magnification and intensity of light enable the operator to actually see the organs through the wall of the intestine.

It is claimed that with the aid of this sexing instrument an operator, after only 120 hours practice, can sex 400-600 chicks an hour with 100 per cent accuracy.

Dairy Herd Replacements lock up Capital

"Generally speaking, the average herd life of a dairy cow in this country is shorter than the average life of a farm tractor. Both are 'capital instruments,' producing a flow of output—the one of power, the other of milk—during their working lives, and to maintain the continuity of this flow, demands the continuing replacement of the worn-out machines. Whereas a new tractor can be manufactured in a matter of days, the production of a new cow takes three years or more. It is true that a tractor costs appreciably more than an average cow, but there are many more cows on farms than there are tractors. Nevertheless, the production of tractors is a concentrated factory process, whereas the production of cows is an extensive farming operation requiring the use of land, buildings, labour, seeds, fertilizers and other resources to maintain a flow of herd replacements for cows wearing out in four years or so, and this overhead burden on the dairying industry is a substantial element in the cost of producing milk. Lengthening the average life of cows (provided lactation yields were sustained), would result not only in lowering milk production costs by spreading the overheads of herd replacement over a larger total production of milk, but also in releasing land, labour and other resources for additional production in other directions.

"A further material point is that the costs of rearing dairy heifers to calving entails a lock-up of capital for approximately three years before this capital yields any return. By comparison with other ways of using working capital, this is a long time to wait. It would obviously be advantageous to reduce the amount of capital so locked up, and this could be done by reducing the need for herd replacements, that is, by extending the herd life of cows. Any reduction in the numbers of heifers needed for herd replacement would release resources in land, labour, seeds, feeds and so on for use in ways yielding quicker rates of return."

So say D. H. Dinsdale and T. Winter of King's College, University of Durham, in their report of a North of England investigation which showed that over a sample of 53 herds, the ratio of young stock to milking cows was 24 to 20, and on average, year by year, only a fraction over 16 cows in every 100 were in their fifth or higher lactation.

S S S

Spring-born Calves cost more to Rear

An addendum to the same report shows that over a full year spring-born calves cost more to rear than autumn-born calves. The former are naturally cheaper over the first six months of life (£13 4*s*., as compared with £16), but in the following six months the autumn-born calves have the advantage (£5 8*s*., as compared with £10 8*s*.). Totals for the full twelve months are: autumn calves, £21 8*s*.; spring calves £23 12*s*.

S S S

War-time Feeding

Mr. James Wyllie, writing in the current issue of the *Empire Journal of Experimental Agriculture*, shows the total number of persons fed from U.K. crops and grass to have been about 17.3 millions in 1939-40, 26.3 millions in 1943-44, 19.6 millions in 1947-48, and 23.8 millions in 1949-50, compared with about 16.7 millions in pre-war years.

The total population of the U.K. in 1951 was 50,369,000, comparing with 46,181,000 in 1931.

Wart Disease of Potatoes

Losses of potatoes due to Wart disease have been greatly reduced by legislation prohibiting the growing of susceptible varieties. Generally speaking, the disease thrives in moderate and cold climates—in practically all countries in north and north-west Europe, except Iceland, Luxemburg, the Saar, Jersey and Guernsey. The disease has appeared in Italy and Portugal, but has apparently failed to establish itself. In Eastern Europe, Wart disease is known to exist in Hungary, Poland, the U.S.S.R., Roumania and Bulgaria.

A virulent strain of the fungus appeared in Western Germany recently and potato varieties previously known to be resistant to the disease succumbed suddenly. But this strain is not known to exist in any other countries in Western Europe, and the legislative measures in force should have provided satisfactory safeguard against its spread.

Lettuce Peat Pots

In a small trial at the Lackham School of Agriculture, Mr. H. S. Bell has been using peat pots in an effort to defeat *Botrytis* in lettuce. His results have been most encouraging, the plants being quite free from diseases and maturing two to three weeks earlier.

The plants are taken from the seedbed, pricked out into the pots filled with sieved John Innes Potting Compost No. 1, then housed in cold houses or under lights until planting-out time. Although the costs of production are increased by the cost of the pots (35*s*. a thousand for No. 1 pots), and the plants require double handling, Mr. Bell claims that adequate compensation lies in freedom from *Botrytis*, no expense for chemical control, earlier cutting and the speed at which the plants can be planted out without being damaged.

The Grower. April 9, 1955

Scotland's Food Producers

"On Scotland's food-producing front there marches an army of 134,000 people—farmers, smallholders, crofters and farm employees. Of that number, over 102,278 are employees and well over 12,000 would-be occupiers of holdings of 50 acres or less, which constitutes a manual force of 114,575. Wives of smallholders and crofters, by personal effort, contribute handsomely to the total of food production, and receive little attention in statistics. Leaving out of account, however, what they do, and what farmers or smallholders of over 50 acres may do in the form of manual work, the gross volume of output per employed man is 25 per cent higher than pre-war. That is an attainment that has not been achieved in any of the other main industries. From one to six years is the period of 'turnover' on the farm. The universal business code of today lays stress on quick returns and if every food producer were to adopt it, several popular home-produced foods would disappear from supply."

Agricultural Directory of Scotland, 1955

Moth-proofing Wool

Recent work at the Wool Research Laboratory of the Commonwealth Scientific and Industrial Research Organization at Geelong, Australia, underlines the wide application of the new insecticide, dieldrin. It would appear from these Geelong experiments that dieldrin in low concentrations is a most effective moth-proofing agent for wool, producing a result which is unexpectedly fast to both washing and dry cleaning.

BOOK REVIEWS

Jersey Cattle. Edited by ERIC J. BOSTON. Faber. 42*s.*

One of the aims of the Editor of this book has been to tell something of the great spread of Jersey cattle from their original island home to many parts of the world, and the marked effect the breed has had on general agriculture as a result of this expansion. At the same time, the opportunity has been taken to make "a picture book" of Jersey cattle. Rich in tonal quality and setting a high photographic standard, the illustrations are indeed the high light of the book, for they tell in a compelling way the story of the great adaptability of the breed—an attribute which belies the Jersey cow's gentle, almost delicate, appearance and which has enabled it to withstand the rigours of both tropical heat and arctic cold.

Further emphasis on the Jersey's adapability is given in the articles by various writers on the breed's development in Canada, the U.S.A., New Zealand, Australia, Denmark, France, South Africa, and many other countries. Not the least interesting of these is Professor Raitheby's article on type in American Jersey cattle, which illustrates the value of show judging and demonstrates that there need be no incompatibility between conformation and high production. Rex Paterson, too, gives much food for thought in his discussion of the value of commercial cross-bred Jerseys as economic milk producers from home-grown foods. All too little is known of the relative merits of different breeds on the basis of production per acre, as opposed to yield per cow, and this author draws a most interesting comparison of the performance of his commercial-grade Jerseys with that of Friesians and Ayrshires under his well-known methods of management.

The Editor's scholarly survey of the origin of domestic cattle, with particular reference to the Jersey breed, while perhaps not of great direct value to the practical breeder, is nevertheless absorbing. The practical man will, however, find much to appeal to him in this book, particularly in the story of the development of the Jersey in its homeland and the way in which various famous lines and families have arisen.

The appendices give some useful information on a variety of subjects connected with the breed, and altogether, *Jersey Cattle* would seem to be a "must" which is destined to appear on the book list of every Jersey fancier and breeder.

R.H.

Bird Recognition (3). James Fisher. Pelican Books. 3*s.* 6*d.*

Any book by James Fisher must command respect, for Mr. Fisher has the dual merit of being an authority of the first rank and a popular broadcaster on his subject. In passing, it may be said that these two attributes are by no means invariably found in company, especially in the sphere of natural history.

The publishers say that this work, of which this forms the third volume, dealing with the rails, game-birds, and the larger singing and perching birds, "has probably the widest circulation of any bird book in Europe". This may well be true, and such a distinction is both understandable and well deserved. It is hard to believe that a better "potted" aid to bird recognition exists or will appear anywhere.

The habitat keys and the year-cycle charts are interesting and useful features. I do not remember seeing the former in any previous work on natural history; the latter has been used in certain books on mammals, but it is rather surprising that its use has not become more general. The distribution maps, too, are most valuable, as are the bibliographical references.

In the main, the illustrations are adequate, but are of rather uneven merit. Some are excellent; others—notably those of the red grouse, wryneck and nightingale—are poor. The last-named bird is always a difficult subject in black and white, and, indeed, it is rare to find a drawing in this medium that is readily recognizable.

This small criticism apart, at 3*s.* 6*d.* this book is surely the best value of its kind obtainable today. It contains all the essentials, and although, as the introduction has it, "all bird books are out of date before they are published", the beginner in ornithological study who relies on it cannot go far wrong.

F.H.L.

BOOK REVIEWS

Two Acres Unlimited. CAROLA COCHRANE. Crosby Lockwood. 10*s.* 6*d.*

In this book Miss Cochrane has given a very readable and interesting account of her struggles and experiences in building up a small, mixed horticultural holding. It is not a text-book of horticulture—indeed, it is far removed from that—yet in the first few chapters, in which the author describes how she started her holding and how she equipped and staffed it, there are many useful hints and much information which the beginner will not readily find elsewhere.

The greater part of the book is concerned with how the many crops produced on this small market garden are grown. The details in many instances are far too sketchy and of no real value. In the few cases where more detail is given, the information is not too clear, and sometimes even a little misleading. It is very disturbing, for example, to find that sodium selenate is recommended as a control for Chrysanthemum eelworm: it certainly does control this pest very satisfactorily, but the dangers attached to its use are too great to warrant its recommendation. It is to be hoped that the advice given will not be seized upon as the only way of controlling this pest.

Miss Cochrane writes in an entertaining and pleasant style. There are some technical mistakes, and unfortunately most of these relate to the major crops. Despite these, however, *Two Acres Unlimited* will no doubt attract a wide public. It will appeal to the person interested in horticulture, rather than those actively engaged in the industry, and may help the uninitiated to appreciate some of the difficulties of intensive crop production.

W.C.

Report of the Recommendations Committee of the British Weed Control Council, 1954. 2*s.* 6*d.*

The first report of the Recommendations Committee of the British Weed Control Council, which proved to be of immense value to adviser, technologist and progressive farmer alike, has now been revised and enlarged. In it are given recommendations for the use of herbicides in agricultural and horticultural crops, and the susceptibilities of over 200 weeds to the herbicides commonly used are categorized. There are recommendations concerning herbicides in forest nurseries, on lawns and sports turfs, and against woody weeds; guidance is also given on the use of potato-haulm killers, non-selective weed-killers, and pre-harvest sprays for clover and lucerne seed crops. A good deal of space is devoted to matters of law and the principles of application, while details of newer herbicides, some of which are still in the experimental stage, form an interesting section at the end.

The rapid progress that has been made in weed control in recent years has been rather bewildering, but it has all been recorded here in concise form, so that in this one publication adviser, contractor and farmer have an up-to-date and comprehensive guide to the practice of chemical weed control which is drawn from the experience of both research worker and practical user.

Copies of the report are obtainable from Mr. W. A. Williams, Hon. Treasurer, British Weed Control Council, Cecil Chambers, 86 Strand, London, W.C.2.

S.E.

University of Nottingham, Department of Horticulture Research Report, 1954. 2*s.*

The publication of a first Research Report by the University of Nottingham Department of Horticulture is an event of some moment. This modest booklet is therefore welcome, not only for the immediate value of its contents but as an earnest of what this youngest of our University Schools may be expected to contribute to new knowledge on old horticultural skills. The promise is that " the art of doing the right job, in the right way, and at the right time " need not remain the exclusive preserve of the craftsman; for this research at Sutton Bonington should lead to a better understanding of the essentials in various practical techniques and make it possible to devise standardized " best ways " which could be safely entrusted to relatively unskilled hands.

The John Innes work on standardized seed and potting composts is now a classic example of the value of such lines of inquiry. Dr. J. P. Hudson and his colleagues in the work reported here are breaking new ground in a similar field, and already their work on the watering of tomatoes under standardized water regimes and on the best season for propagating root cuttings is becoming known. This report, in addition, gives brief accounts of other lines of investigation on leaf cuttings, vegetable seed sowing and the transplanting of seedlings. As a simple introduction to the work of the Department, the report can be commended to grower and educationist alike.

R.T.P.

BOOK REVIEWS

British Standards Nos. 2503, 2504 and 2505: 54. British Standards Institution. 2s. 6d. each.

The British Standards Institution have published three additions to their series of standard specifications. No. *2503:54* (*Steel Windows for Agricultural Use*) deals with three types of hopper-opening windows suitable for cowhouses, piggeries and most farm buildings, and refers to manufacture, fixing, dimensions and rust-proofing. The illustrations in the text are clear and useful to draughtsmen in the preparation of detailed drawings, and the inclusion of glass sizes in the specification will be helpful when ordering building materials.

No. 2504: 54 (*Wood Doors and Frames for Milking Parlours*) describes the construction of two types of door—the framed, ledged and braced, and the "flush" pattern. The specification is comprehensive in respect of these two types, but it is felt that it could well have encompassed a wider range of doors suitable for livestock buildings. With some variation in dimensions, such doors would normally follow the same specification closely enough to be identified with this publication.

No. 2505: 54 (*Cowhouse Equipment*) embraces both steel and concrete mangers, stall divisions, and troughs. The dimensional diagrams are informative, and the specification embodies a reference to B.S. Standards of materials used in the manufacture of these fittings. It is to be regretted, however, that the tubular steel stall division is restricted to a type which involves the burial of an unusual amount of steel tubing beneath the floor of the standing, since, in my opinion, this makes replacement unduly difficult in the event of breakage through corrosion or any other cause.

Copies of the Standards are obtainable from the British Standards Institution, British Standards House, 2 Park Street, London, W.1.

F.W.H.

The Agricultural History Review (Vol. III, Pt. 1). 12*s.* 6*d.*

The latest issue of the *Agricultural History Review* continues the general pattern established by its predecessors. In the substantial main articles Dr. Hilton of Birmingham University analyses the sources of early agrarian history in this country, Dr. Kerridge of Liverpool University discusses ridge-and-furrow and inter-strip balks, and Mr. Davidson adds agreeably to our knowledge of folk-lore surviving influentially into modern times. Nine recent books are reviewed and various notes summarize minor items of news and the domestic business of the Society. The latter, incidentally, includes a reference to conference papers, which might well receive a separate section in the invaluable list of books and articles published since the last issue of the *Review*.

Details of the Society can be obtained from the Secretary, the Museum of English Rural Life, 7 Shinfield Road, Reading. Membership is open to all interested in agricultural history, the subscription is one guinea a year, and all members receive the *Review* free of charge.

N.H.

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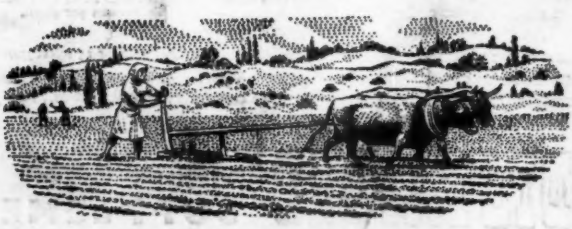
The Romans had a machine for it

AS early as the first century A.D., the Roman historian Pliny noted a machine that stripped the ears from corn by means of a tined comb cutting at ear-high level. In the fourth century Palladius also wrote about this primitive machine, as follows :—

"In the plains of Gaul, they use this quick way of reaping and, without reapers, cut large fields in one day . . . When this machine is pushed (by a trained ox) through the standing corn, all the ears are comprehended by the teeth and heaped up in the hollow part of it, being cut off from the straw which is left behind, the driver setting it higher or lower as he finds it necessary ; and thus by a few goings and returnings the whole field is reaped."

This ingenious machine could hardly have coped with today's harvests, for yields have increased vastly since the time of the Romans. This is due to modern high-yielding varieties and the widespread use of nitrogen in the form of Sulphate of Ammonia or 'Nitro-Chalk'.



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